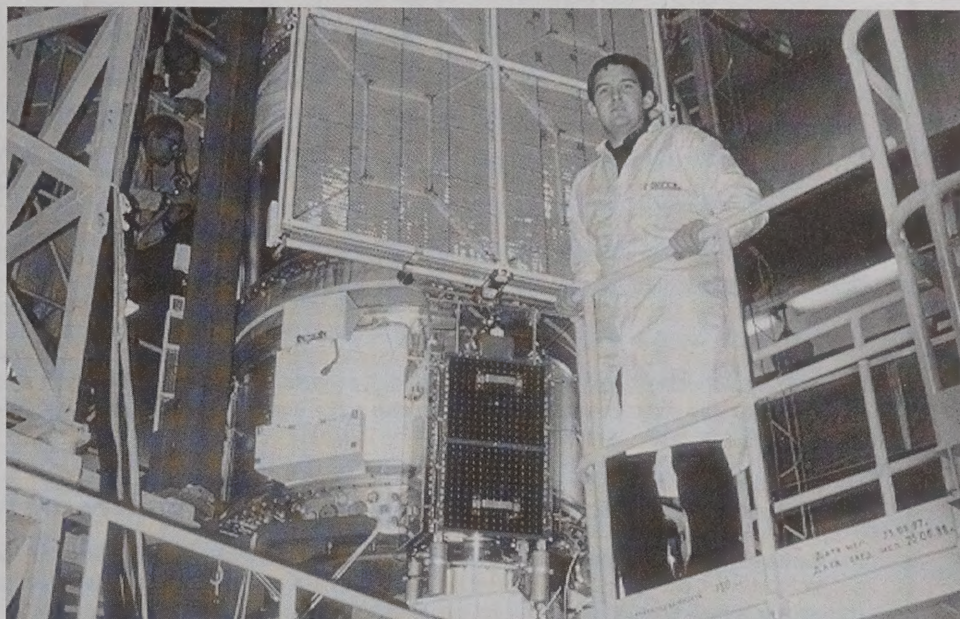
The AMSAT® Journal

Editor
Russ Tillman, K5NRK

Editorial Staff
Ron Long, W8GUS
Buzz Gorsky, WH6I
Andy Reynolds, WD9IYT

Volume 21, No. 4 July/August 1998

CONTENTS



Chris Jackson, G7UPN standing next to TMSAT-1 attached in flight configuration to the RESURS-O1 #4 spacecraft during the integration in Moscow in April 1998. TechSat will be mounted next to TMSAT on the white bracket to the left of TMSAT. FASat-B, a Chilean SSTL non-amateur spacecraft is mounted on the other side of RESURS (see "FASat-Alpha, the First Chilean Satellite" in July/August 1995 issue of *The AMSAT Journal*). RESURS is an Earth-imaging spacecraft and also carries a Meteor meterology payload (among others). The back of one of the RESURS solar arrays which is folded in three parts is visible above TMSAT.

TMSAT-1 Successfully Launched into Orbit

Chris Jackson, G7UPN/ZL2TPO

Surrey Satellite Technology Ltd, University of Surrey

Amateur Radio satellite TMSAT-1 was successfully launched from Baikonur Cosmodrome in Russia on the morning (0630 UTC) of 10 July 1998 into an 821km sun-synchronous orbit on board a Zenit launch vehicle. It was attached to the RESURS-O1 #4 spacecraft and was separated from this satellite after launch via a command from the RESURS command station near Moscow. The initial TMSAT operations from the Bangkok command station were performed during the first passes over Thailand following the separation.

[continued on page 4]

AMSAT-NA
850 Sligo Avenue
Silver Spring, MD 20910

07253 N8GNJ 1999.05
[redacted]

Periodicals

POSTAGE PAID

At Silver Spring, MD and at additional mailing offices

Radio Amateur Satellite Corporation (AMSAT-NA)
850 Sligo Ave., Silver Spring, MD 20910-4703
Telephone: 301-589-6062 Facsimile: 301-608-3410
AMSAT-NA Club Call Sign - W3ZM
AMSAT WWW: http://www.amsat.org

The AMSAT Journal **Staff:**
Editor in Chief: Russell K. Tillman, K5NRK
Circulation: Martha Saragovitz
(*martha@amsat.org*)

Editorial Staff:
Ron Long, W8GUS
Buzz Gorsky, WH6I
Andrew Reynolds, WD9IYT

AMSAT-NA Board of Directors:
Tom Clark, W3IWI, Dick Daniels, W4PUJ,
Stan Wood, WA4NFY, Bill Tynan, W3XO,
Joe Holman, AD7D, Keith Baker, KB1SF,
Andy MacAllister, W5ACM

AMSAT-NA Officers:
President:
Bill Tynan, W3XO
Executive Vice President:
Keith Baker, KB1SF
Vice President, Operations:
Keith Pugh, W5IU
Vice President, Engineering:
Stan Wood, WA4NFY
Vice President, Manned Space Programs:
Frank Bauer, KA3HDO
Vice President, International Affairs:
Ray Soifer, W2RS
Vice President, Field Operations:
Barry Baines, WD4ASW
Vice President, User Services:
Andy MacAllister, W5ACM
Vice President, Canadian Liaison:
Robin Haighton, VE3FRH
Vice President: Electronic Publishing:
Paul Williamson, KB5MU
Vice President, Development:
Harwood Sheppard, AA7MH
Vice President: Strategic Planning:
Bill Burden. WB1BRE
Founding President Emeritus & VP, Government Liaison:
Perry Klein, W3PK
Treasurer:
Art Feller, W4ART
Corporate Secretary:
Martha Saragovitz
President Emeritus:
Tom Clark, W3IWI

Editorial Office: Russ Tillman, K5NRK, 113 Rollingwood Drive, Vicksburg, MS 38913-9571, Internet: *k5nrk@amsat.org*, telephone and fax: 601-634-6398.

Advertising Office: AMSAT-NA Headquarters, 850 Sligo Avenue, Suite 600, Silver Spring, MD 20910-4703.

The AMSAT Journal (ISSN: 1407-3076) is published bi-monthly (Jan, Mar, May, Jul, Sep, Nov) by AMSAT-NA, 850 Sligo Avenue, Silver Spring, MD 20910-4703. Telephone: 301-589-6062, fax: 301-608-3410. Periodicals postage paid at Silver Spring, MD, and additional mailing offices. Postmaster, send address changes to *The AMSAT Journal*, 850 Sligo Avenue, Suite 600, Silver Spring, MD 20910-4703.

The AMSAT Journal staff is always interested in article submissions. Whenever possible, text should be on IBM compatible diskette with hard copy or original photographs or figures. AMSAT-NA reserves the right to select material for *The AMSAT Journal* based on suitability of content and space considerations. The editors of this publication are volunteers giving freely of their talents, time, and efforts to produce *The AMSAT Journal*.

Phase 3D Launch and Where Does AMSAT Go From Here?

Bill Tynan, W3XO

As you have probably heard by now, Phase 3D will not be launched on the third test flight of Ariane 5. The bad news reached Karl Meinzer, DJ4ZC President of AMSAT-DL and Project Leader of the Phase 3D Project on Monday, June 15th, and he immediately informed the Project workers of the unfortunate tidings. I called Karl that afternoon to discuss our options and future plans. Although, naturally very unhappy at learning the final ESA decision, he was, nevertheless, resolute with regard to completing and testing the satellite, and thus having it available for any launch opportunities which we may be able to obtain.

Although I released the complete information immediately via AMSAT-BB and later in an AMSAT News Service bulletin, I believe it appropriate to again summarize the situation here.

The important thing to point out is that the decision was actually made by Arianespace, not ESA. As you should know by now, ESA is the European Space Agency. It is similar to our NASA, except that it is multi-national. Arianespace, is the organization set up to market Ariane launches. So, naturally, its prime interest is money. Because of the failure of the first Ariane 5 test, A-501 in June 1996 and the less than expected performance of the second flight, A-502 last October, all concerned have been understandably anxious to complete a fully successful test as soon as possible. Arianespace cannot begin to sell Ariane 5 launches until a successful test takes place. The failure of A-501 and the lower than expected performance of A-502 have caused a stretch-out of the program and hence increased the cost of the development phase.

ESA has been anxious to recoup some of these additional costs. As a result, they asked Arianespace to try very hard to find a paying customer for A-503. A figure of somewhere around THIRTY-FIVE MILLION dollars was mentioned. This is about half of the amount usually paid to launch a present-day commercial satellite on an operational launcher, and the lesser amount is indicative of the fact that Ariane 5 is not yet operational. ESA even signaled a willingness to delay the flight until a suitable customer could be found. This shows how serious they were in wanting to recoup some of the financial losses they have suffered as a result of the delays and problems that have befallen the Ariane 5 program.

Of course, we were afraid that if a paying customer could be found, we would have little chance of being included on the flight. So, even though we didn't wish ESA any ill, we, nevertheless, were hoping that no commercial satellite operator would be willing to risk a ONE-HUNDRED to TWO-HUNDRED MILLION dollar spacecraft on the A-503 test flight. Until a few days before the final decision, it appeared that our hopes would be realized. But, at the last minute, Arianespace itself decided to become the customer and offered ESA approximately FORTY-MILLION dollars to be in a position to dictate the composition of the payload for the flight.

Why did they do this, and what are they going to launch? Their final selection is not known to us as of the time this is being written, but it might well be a dummy spacecraft. Or, they may find a real spacecraft and sell its facilities once in orbit, just like any satellite operator would. But why would anyone pay FORTY-MILLION dollars to launch a dummy spacecraft? The answer is quite simple. Arianespace wants to, and needs to, start selling Ariane 5 launches as soon as possible. Therefore, they are willing to put up FORTY-MILLION dollars in order to complete the test program and start collecting revenue for operational Araine 5 launches. Not surprisingly, having put up that much money, they are not interested in delaying the launch any longer in order to have ESA do the engineering work necessary to include Phase 3D.

The bottom line is that Phase 3D will not ride on Ariane 503.

We are disappointed of course, but crying and gnashing of teeth never accomplishes anything. So, where do we go from here?

We are taking steps to complete the testing of Phase 3D and have it ready for any launch

launch **[Apogee View continued from page 3]** that we might be able to obtain. Naturally ESA and Arianespace are prime candidates for our presentations. After all, Phase 3D was designed and built with the then very real prospect of a launch on an Ariane 5 vehicle. It was later determined that, with an appropriate adapter, it could also be accommodated on an Ariane 4. But, because it was built to go on an Ariane, it can't just be put on any rocket that's going up. It is a rather large spacecraft and also quite massive, on the order of 600 kilograms or about 1200 pounds when fully fueled. So, it requires a launcher with quite a large volume under the shroud and substantial performance. The orbit that the launcher puts us into is also important. Generally a GTO (geostationary transfer orbit) is what we need. A launch into a circular LEO (low Earth orbit) would be much less than optimum. Many launches, including the Shuttle, go to such LEO orbits. There are other larger launchers which go to GTO, besides Ariane, and we will be looking at them, but nothing can be promised at this time.

All I can say is, we will do our best and will keep you informed as much as practicable. But, bear in mind, just as was the case during the time that Karl Meinzer was seeking an Ariane 503 launch, it is best not to say too much while delicate negotiations are underway. All too often something said may get back to the wrong person and cause irreparable damage.

So, keep the faith.

Don't merely keep the faith with regard to Phase 3D and efforts to find a launch for it; keep the faith also on the future of AMSAT. Testing of Phase 3D will be completed and the spacecraft made ready for a launch. After that is completed, there are several projects in which our organization will be engaging. One that we have discussed before is the Canadian MOST project. It is, at this moment, awaiting a final go-ahead. In addition, we are assisting with a number of small satellites being built at universities around the country, some of which are to include amateur packages.

Probably the most visible of the projects in which we will be involved is the International Space Station. Our Vice President for Manned Space Programs, Frank Bauer KA3HDO, and his group of volunteers are working with AMSAT groups in a number of countries with some of the administrative aspects of getting amateur radio equipment on ISS. In addition, we and some of these other AMSAT groups will be actually constructing some of the needed hardware to go aboard ISS.

So, there is a lot going on. New amateur satellites are awaiting launch as I write this. They are bound to help keep life interesting while we are all awaiting a launch for Phase 3D. ■

[TMSAT-1 continued from page 1]

TMSAT-1 began sending telemetry on its primary downlink frequency of 436.925 MHz at 1.7 to 2 watts. Also shortly after launch NORAD provided a set of Keplerian elements for TMSAT-1 (see page 13).

TMSAT-1 Characteristics

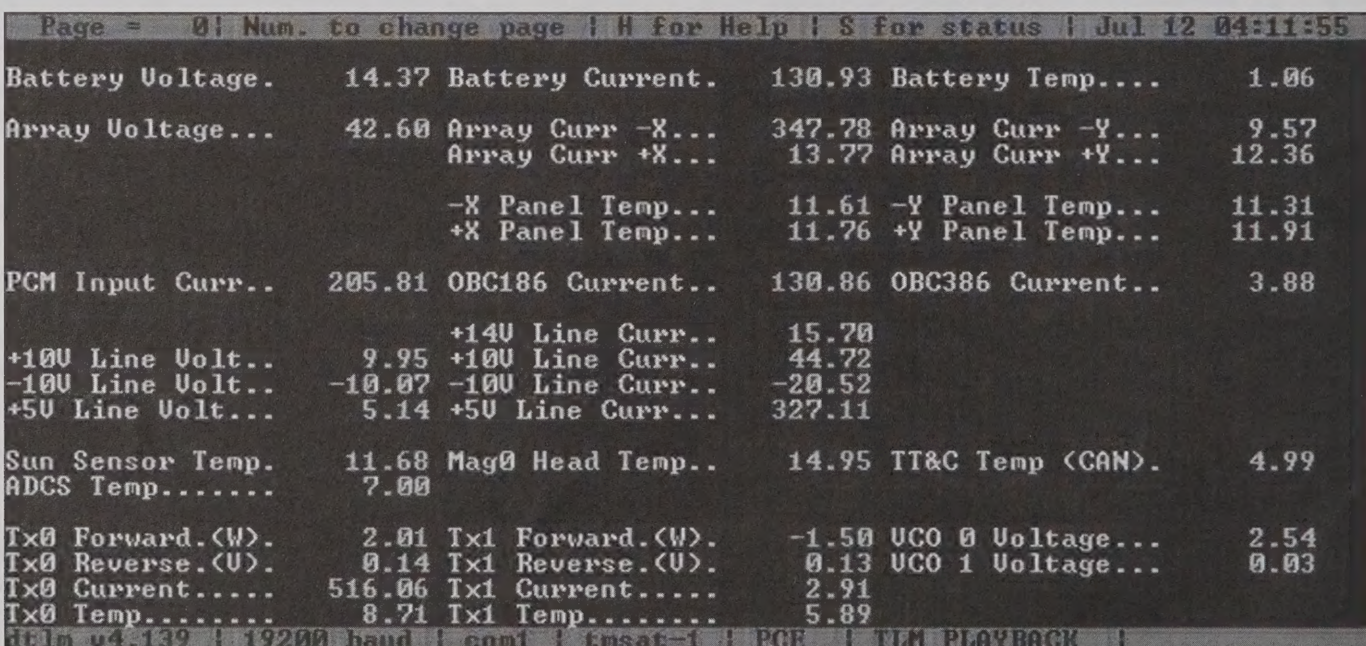
TMSAT-1 carries a high resolution multispectral camera system, scanning communications receivers, digital signal processors, GPS receiver, and store and forward communications payloads. TMSAT Amateur Radio frequencies and callsigns are:

- Uplinks: 145.925, 145.975 MHz
- Downlinks: 436.925 (Primary), 436.900, 436.950, 436.975 MHz
- Callsigns: *TMSAT1* for the OBC186 and *TMSATS* for the OBC386

Following commissioning, it is likely that only one on-board computer (OBC) will be operating, and the callsign will be changed to *TMSAT1* for that OBC (probably the OBC386).

TMSAT Commissioning Plan

The following commissioning plan for the TMSAT microsatellite was written in advance of launch and only provides a general overview of TMSAT. No technical information has been provided. More in depth comments will be posted to the



After launch and separation, TMSAT-1 began transmitting VLSI telemetry in an asynchronous format as shown above. Telemetry collected within two days of launch showed the spacecraft is operating normally. G7UPN's immediate plan for TMSAT-1 is to continue to load flight software on the 186 on-board computer and then start stabilizing the attitude. Afterwards, plans call for switching to more familiar standard OBC telemetry mode .

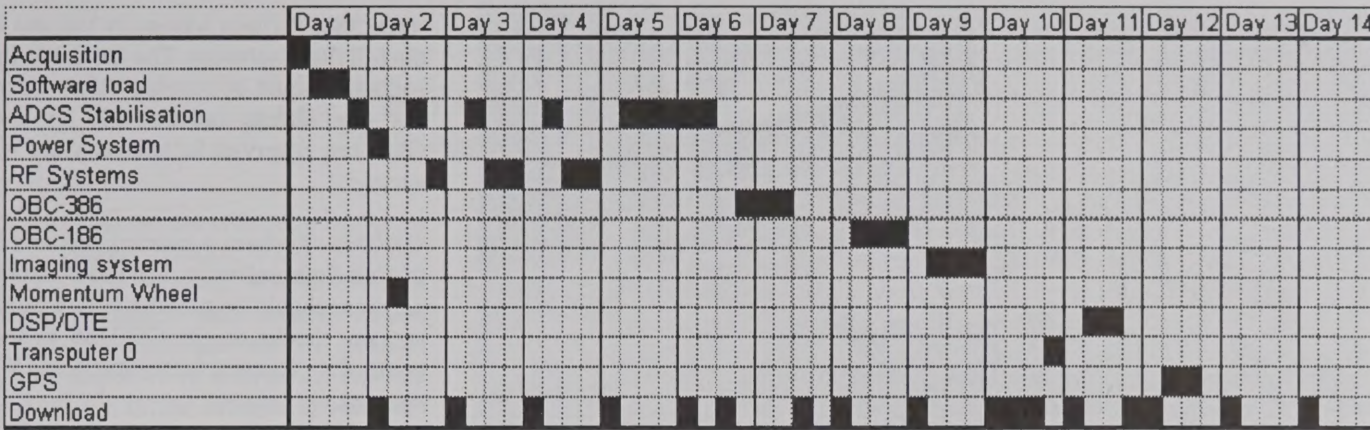


Figure 1. TMSAT-1 commissioning schedule.

satellite as commissioning progresses, and these will also be available on UO-22. All primary commissioning will be undertaken using the 9600 bd downlink so this will be able to be copied by amateurs equipped for the current 9600 bd spacecraft. All commissioning operations will be undertaken from the TMSAT control station in Bangkok, Thailand by HS0ECQ and G7UPN. ***The spacecraft store and forward communications systems will not be available for general use during the commissioning phase. Please do not attempt to communicate with the spacecraft as this may hinder the commissioning process.***

Schedule: The schedule provided as Figure 1 is meant as a guideline only and additional time may be required due to uplink blockages and etc.

Spacecraft Attitude Summary: Figure 2 summarizes the periods that the spacecraft will be in various attitude modes.

Initial Signal Acquisition: During the first orbital pass the signal must be acquired from the satellite and telemetry received. All primary telemetry points must be checked. Transmitter Power must be on and command team must wait until the spacecraft is predicted to be at +5° elevation. Once a modulated signal is verified the the command team must ensure that telemetry is being received. Once telemetry is being displayed, the following telemetry points should be monitored:

- Transmitter forward and reverse power and current: If these show abnormal values the transmitter should be turned off immediately.
- Power rails: +14V, +10V, -10V, +5V.
- Battery condition: Temperature, Voltage, Current.
- Panel performance: Current generated from panels.
- Receivers: RSI, Discriminator.

The command team will verify that the spacecraft can be commanded with the transmitter on and continue monitoring telemetry for the remainder of the pass to ensure that no anomalistic readings are received. The transmitter should be left ON between passes unless anomalous telemetry is received that indicates a problem with the spacecraft.

Flight Software Load: The flight software must be loaded to the primary OBC186 to allow further payload and bus system checks to be completed. This will take two passes, and telemetry must be restored before the end of the pass. Once there is less than three minutes until LOS, the spacecraft should be commanded back to VLSI telemetry using the VLSI TLM ON command sequence and telemetry checked to ensure that no anomalistic readings are received.

Power System: To confirm correct operation of the power system the command team will run a Power System WOD at 10 per second sampling period for 6 hours. Afterwards, the team will download this WOD survey and confirm that all systems are operating normally.

Attitude Stabilization: The attitude stabilization phase may take a number of days to complete and during this time other payloads may be commissioned if time permits and the power budget is maintained. Before boom deployment can be performed, reasonable Keplerian elements must be received from NORAD. An overview of the attitude stabilisation procedure follows:

- Post separation the angular rates are not known and may be high so a simple algorithm may be used to remove some of the angular velocity. A fast WOD magnetometer survey will be performed to ascertain the angular velocity and if it is too fast (1.5 degrees per second) then the ADCS task will need to remove some of this velocity before establishing Y-Thomson mode. Once the angular velocity has been slowed, the spacecraft is placed into Y-Thomson mode.
- As soon as reliable Keplerian elements are available, the rate determination mod-

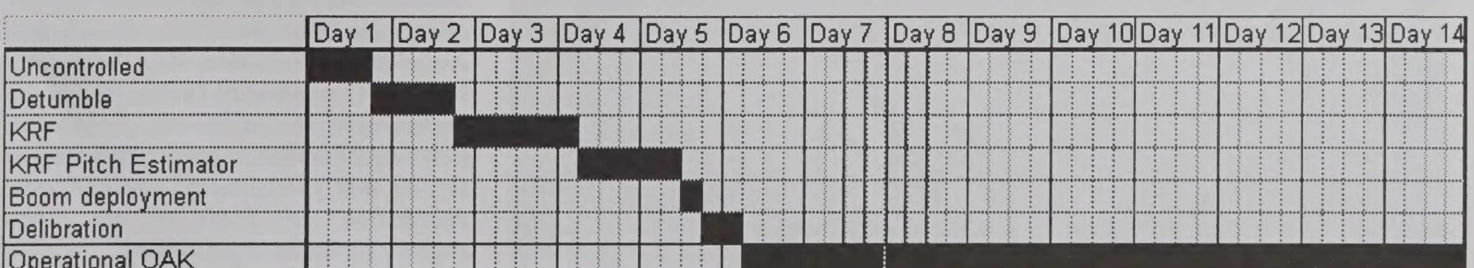


Figure 2. TMSAT attitude mode schedule.

The TMSAT-1 Commission Team in Bangkok, Thailand shortly after the launch of TMSAT-1. From left to right are Chatpetch Bunyakate, Pavinee Hongprayoon, Chris Jackson G7UPN, and Withaya Wongakantis, HS0ECQ.

ule can be enabled to provide real-time readout of spacecraft pitch angle.

- Just prior to boom deployment the AtAcq task is disabled.
- Boom deployment is performed as the spacecraft pitch angle reaches nadir pointing. This is performed autonomously by the AtAcq task. A simple delibration algorithm is used to provide initial nadir pointing.
- The spacecraft attitude control software is reloaded to enable the operational pointing mode.

Payload Commissioning: The payload and bus system commissioning is scheduled in an order which contains dependencies and priorities.

Transmitters:

- TX0: Select nominal transmit frequency and ensure that data can be received at 9600bd and 38k4. Record indicated forward and reverse power.
- TX1: Select nominal transmit frequency and ensure that data can be received at 9600bd and 38k4. Cycle through the power settings and record indicated forward and reverse power.

Receivers: Ensure that data can be uploaded on both bus receivers, on primary and secondary frequencies with and without AFC.

SSTL Launch Team in Moscow during spacecraft integration in April 1998. The spacecraft on the left is FASat-Bravo and the the right is TMSAT-1. From left to right are Andy Currie, Maartin Meerman, Chris Jackson, Keith Clark, and Victor Van der Zel.

OBC386: Perform a memory test and load the full flight software. The OBC-186 flight software should be running before carrying out any checks on the 386 to ensure continuity of service for telemetry and WOD surveys.

OBC186: Perform a memory test and load the full flight software. The OBC-386 flight software should be running before carrying out any checks on the OBC186 to ensure continuity of service for telemetry and WOD surveys.

Transputer 0: Load test software to the transputer and execute the tests.

Imaging System: Load flight software to the transputer. Capture images from all cameras, transfer to OBC and download to ground.

DSPs: Perform a memory test, power consumption check and IF loopback.

DTEs: Ensure that the receiver is functioning correctly by commanding through the DTE and run an RSI scan on both DTE receivers from 140MHz to 150MHz.

Momentum Wheel: This procedure is performed immediately after the detumbling phase, when the satellite is in a Y-Thomson spin of about 1.5 deg/s. The momentum wheel will be set to a speed reference of about 1000 rpm. This should either decrease the Y-body spin to about 0 deg/s. This will be checked by looking at the magnetometer output. After about 3 minutes maximum, the wheel will be switched off and will stop automatically under friction in about 3 minutes. The satellite will return to its initial Y-Thomson spin of 1.5 deg/s.

GPS: Check telemetry values from the GPS. Load and run memory test software via the CAN interface.

Editor's Note: A special thanks to Chris Jackson, G7UPN and his TMSAT-1 team for taking the time to share launch and commission information with the Journal and AMSAT community. During the first few hectic days after the launch of TMSAT-1, Chris took the time to provide many status reports and photographs. For additional information on TMSAT-1 see Chris Jackson's article titled "38k4 "Receiver Requirements" in the November/ December 1997 issue of The AMSAT Journal. ■

No RISC, No Fun!

Peter Gülzow, DB2OS (*db2os@amsat.org*)
Translated by Don Moe, KE6MN/DJ0HC

No RISC, no fun is the new motto for Chuck Green, N0ADI; Peter Gülzow, DB2OS; Lyle Johnson, WA7GXD; Karl Meinzer, DJ4ZC; and James Miller, G3RUH, who in the shortest time possible have developed a new high-power onboard computer for future satellite applications (Figure 1). If all goes as planned, this new computer will be subjected to its baptism of fire aboard the AMSAT Phase 3D satellite and demonstrate its capabilities at the same time.

It had already become clear during the development of the Phase 3D satellite that the old onboard computer (Integrated Housekeeping Unit, abbreviated IHU) would be scarcely up to the challenge of future projects. However, no reliable alternative was available and the IHU had been successfully flown on OSCAR-10 and OSCAR-13 in the 1980's. Since it is the most important single element of the Phase 3D satellite, all risk should be avoided. A permanent failure of the onboard computer would result in the complete loss of the entire mission. Therefore the old reliable technology was used.

The old IHU was based upon the COSMAC 1802 technology from the 1970's. The 8-bit CPU is still being manufactured and marketed by Harris. However, we use a radiation hardened version from Sandia Labs that was left over from former projects. The CPU is operated at a clock frequency of 1.6 MHz and thereby executes approximately 100,000 instructions per second. By today's standards that is very few, but in outer space everything happens so very slowly that the software spends most of its time in waiting loops.

For Phase 3D several improvements were envisioned for the IHU since more telemetry and control channels were required, among other things. The basic design of the IHU has not changed significantly compared to OSCAR-10 or OSCAR-13.

Evaluating Processors

For quite some time we have had alternative processors under review. There is a whole series of very interesting processors available on the market for so-called embedded applications, even the Pentium CPU. Many of these CPUs were quickly rejected after brief consideration since they often exhibited excessive power dissipation or their designs were not suitable for use in outer space. Only those CPUs could be considered that were built using fully static CMOS technology and that exhibited extremely low power consumption and dissipation. Modern Pentium processors requiring over 5A of power can be cited as an example since every user doubtless is aware of the annoying fan noise from his computer.

In addition to its radiation hardness, the power dissipation is the decisive aspect in choosing a processor. In a vacuum, only approximately 15-20 mW/cm² can be radiated from an ideal black surface. Additional means of cooling are often mechanically complicated. On the other hand, raising the temperature by 10° Celsius reduces the lifetime by one half.

However, even more important than the CPU are the development tools. Since a new IHU would again operate with IPS as its operating system, the plentifully available assemblers and C compilers are not of much value. For the old IHU, the Atari 800 running IPS was used for both software development and the control software at the command stations. For some time now, comparable programs for a PC running Windows-95 have been available, although no IPS tools for developing and testing new IPS programs are available. James Miller, G3RUH, has been using the Acorn RiscPC for a long time, which is widely available in England, and has ported the IPS system in addition to all command software.

The Atari ST with the 68000 CPU briefly represented a further alternative for software development. However, this project was terminated after Atari abandoned the computer business. The Acorn RiscPC is however a readily available system that is capable of compiling the complete IPS code for the IHU. Such a cross development tool is very important since a whole series of software changes and enhancements will be required for the IHU to support such tasks as 3-axis stabilization. Furthermore, we do not wish to forego the comfortable environment of present-day computers. A cassette recorder was the only storage device available for the Atari 800.

The Acorn RiscPC is based upon the SA-110 StrongARM from Digital Equipment Corporation (DEC) and is operated at a clock frequency of 233 MHz. Still the RISC processor remains fairly cool since it dissipates less than 300 mW. At the

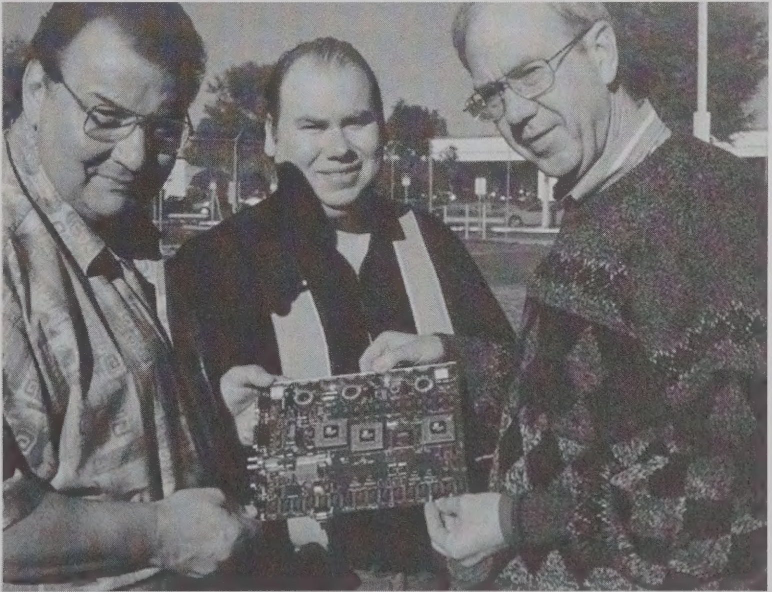


Figure 1. Werner Haas, DJ5KQ; Peter Gülzow, DB2OS; and Chuck Green, N0ADI with the YAHU Prototype (photo by W. Gladisch, AMSAT-DL)

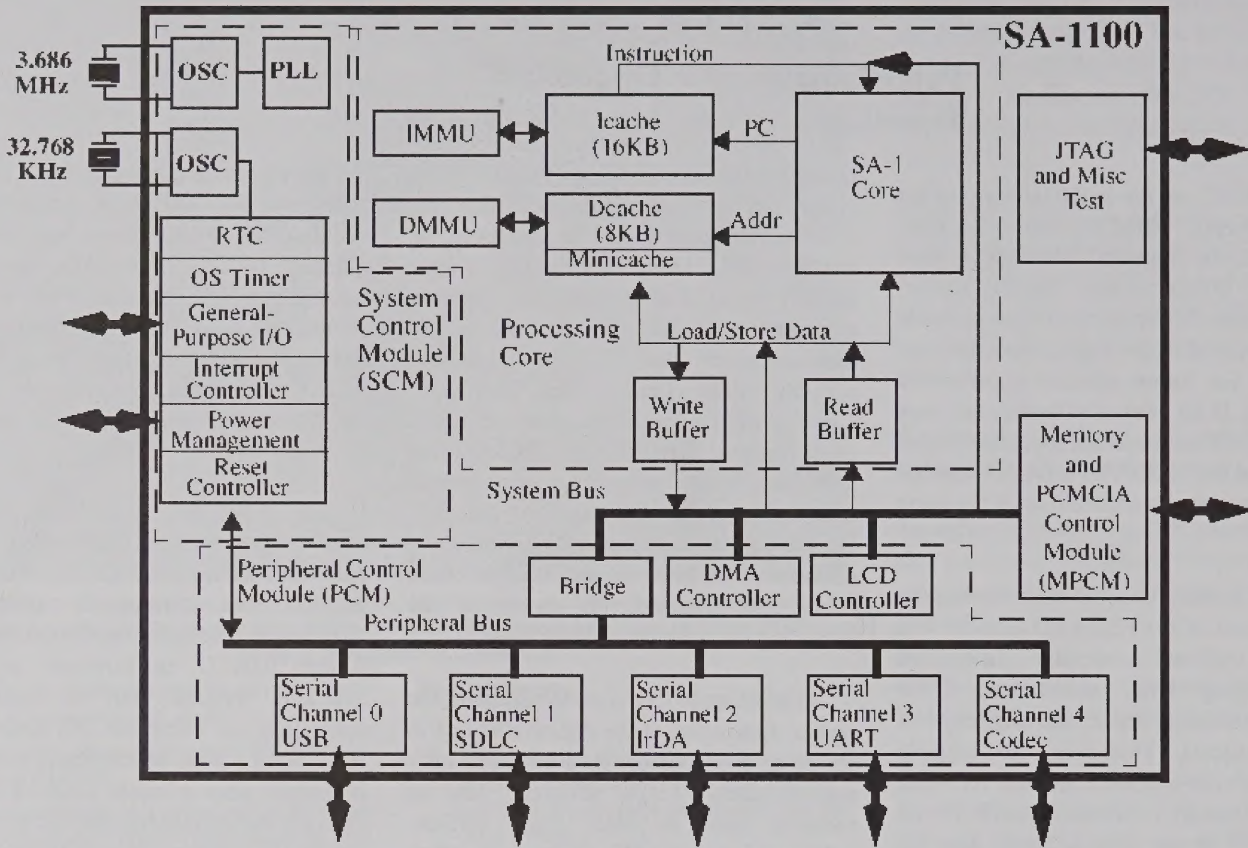


Figure 2. StrongArm SA-1100 Processor.

end of 1997 Digital announced an enhancement to the SA-110, the StrongARM SA-1100 with clock frequencies of 133 MHz and 200 MHz. The SA-1100 is a 32-bit RISC processor with an instruction cache of 16 kB and a data cache of 8 kB. It differs from the SA-110 used in the Acorn RiscPC mainly due to the integration onto the chip of a MMU and a whole set of functions for peripheral devices. Among other things, this includes four different serial multi-function interfaces, parallel interfaces, DMA, PCMCIA and LCD drivers, real-time clock, timer and clock generation, as well as functions for power management. The target market of this CPU is portable computers, such as PDA's, notebooks, organizers, etc.

We quickly recognized that the SA-1100 would be an ideal processor for a new IHU (Figure 2). Naturally it is fully static and exhibits an exceptionally low power dissipation of 200 mW at 133 MHz and 250 mW at 200 MHz. Its processing speed is rated at 230 MIPS (Dhrystone 2.1) at 200 MHz. It is therefore the most powerful processor on the planet as far as the MIPS per Watt rating is concerned!

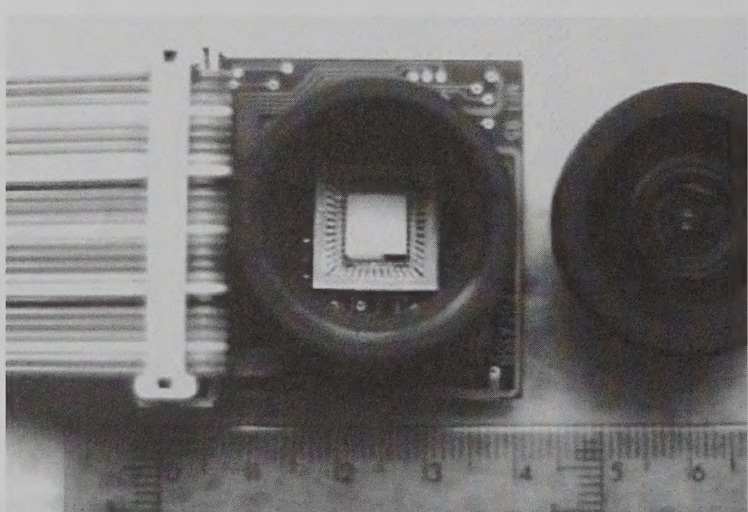


Figure 3. CMOS APS camera in a size comparison.

On May 17, 1998 the entire operation of StrongARM, PCI bridges and network components, along with the chip fabrication facility in Hudson, Massachusetts, was transferred from DEC to Intel. Intel will continue development and manufacture of the SA-1100 and subsequent products. In the future Digital will only pursue further development of the DEC Alpha microprocessor and its systems. Hence Phase 3D will also fall under the category *Intel Inside*. Anyone interested in learning more about the StrongARM can find considerable information at Intel's website on the Internet under the URL: *http://developer.intel.com/design/strong/*

Unfortunately, no data or reports are available regarding radiation hardness. Dynamic memory and processors customarily employ CMOS differential amplifiers at switching levels in the range of 100 mV. These components commonly fail at relatively low radiation levels of 1 kRad and become unusable. Fully static CMOS components have however a significantly higher *natural* radiation hardness that lies at least one, often even 2 or 3 orders of magnitude higher. Specific components can certainly be irradiated, but only their successful deployment in outer space will truly clarify the matter.

Yet Another Housekeeping Unit

What would be more appropriate then than to fly the StrongARM SA-1100 on AMSAT Phase 3D?

Fascinated by the possibilities of a new IHU based on the StrongARM SA-1100, a working group was quickly formed. Our Phase 3D project manager, Karl Meinzer, DJ4ZC, immediately offered a chance to fly with Phase 3D, provided that the project is completed on time for integration and there are no problems with its mass. A free location was quickly found within the satellite for the module. It goes without saying that the previous IHU onboard computer will not be replaced. Additionally AMSAT-DL decided to support the project financially since it will prove to be important for future satellite projects.

In December 1997, AMSAT-DL held a three-day design meeting in Marburg so that the new onboard computer could be realized as soon as possible. Prior to the meeting, important technical details were discussed and determined, including the mechanical dimensions, weight and power consumption. A method had to be devised to integrate the new module into Phase 3D with the least possible effort and the fewest alterations to the cable harness. Since the originally planned 10m broadcast transmitter could not be completed on time, the new onboard computer has occupied its place. The required changes to the cable harness were therefore minimal.

An internal name for the project was also quickly found while enjoying a round of beers: YAHU, the acronym for *Yet Another Housekeeping Unit*.

A list of system goals was started and all participants in the working group contributed many new ideas for the development of YAHU, also known as IHU-2. Lyle Johnson had already created a substantial portion of the circuit design and FPGA logic. The team discussed each subsystem individually. Lyle Johnson was also nominated by the group to be project leader for the new IHU-2.

Although YAHU is significantly more complex than the old IHU, the effort and space for individual components could be drastically reduced through the use of so-called FPGA's. The CMOS logic arrays employ the co-called *anti-fuse* technology and are thus particularly well suited for use in outer space. A radiation hardness level of at least 50K to 100 KRad (Si) can be expected. In all, three FPGA components will be used to hold the entire boot logic, command decoder, memory logic, EDAC, etc.

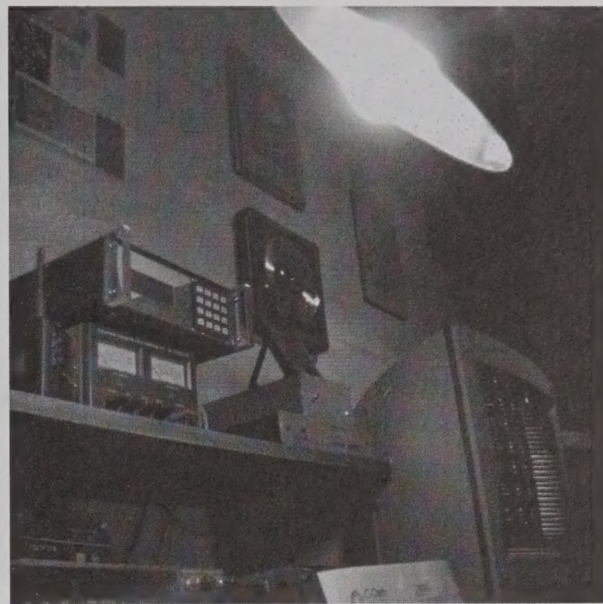


Figure 4. Extreme light differences recorded by the YACE prototype. (photo by Peter Gülzow, DB2OS)

While participating in the Phase 3D systems integration in Orlando in March 1998, Chuck Green (Figure 1) presented the first YAHU prototype which he had just populated with components and soldered. The YAHU consists to a large extent of SMD parts. Subsequently the prototype was sent by courier to Tucson, Arizona, where Lyle Johnson was eager to begin testing it. Chuck Green is responsible for the entire circuit board layout and manufacture. He had previously demonstrated his superb craftsmanship on the IHU, RUDAK and other circuit boards.

As a comparison of their relative speeds, the 32-bit IPS version running on the SA-110 clocked at 200 MHz will be nearly 5,000 faster than on the old Cosmac 1802 IHU. Thanks to its vertical structure and compact code, IPS-32 can run almost completely within the two cache memories. However, the data cache in the newer SA-1100 was unfortunately reduced from 16 KB to 8 KB. The speed improvement is nevertheless enormous.

So that the new YAHU does not become an end in itself and merely kill time in waiting loops on Phase 3D, the functionality has been extended well beyond that of a normal onboard computer. Thus the YAHU will have a modem interface at the 10.7 MHz IF level with A/D and D/A converters (I/Q). The job of the DSP will naturally be performed by the StrongARM. This will allow, in addition to higher data rates, other modulation and encoding techniques to be evaluated for suitability, such as would be needed for a deep space mission to Mars.

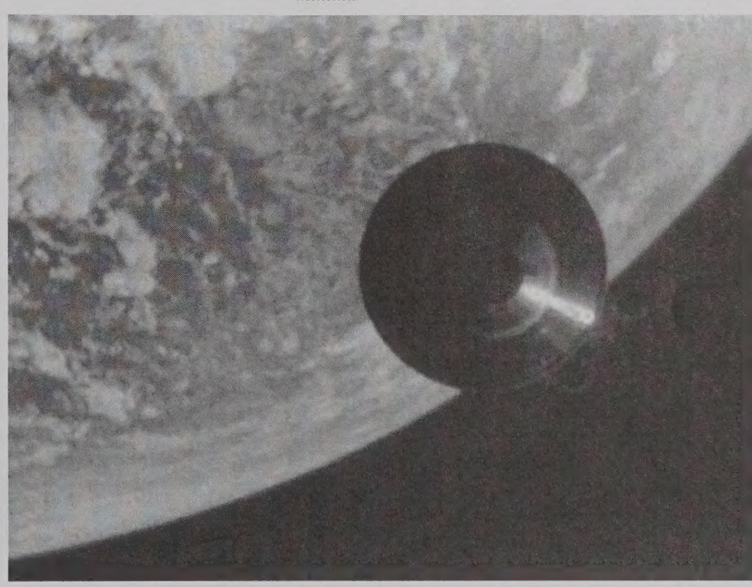


Figure 5. Fifteen seconds after separation of the MAQSAT-H and SPELTRA from the Ariane 502 as recorded by the TEAMSAT VTS System.

Figure 6. First telemetry test transmission from YAHU. (photo by Lyle Johnson, WA7GXD)

Yet Another Camera Experiment

But not only that, YAHU also will have its own eye. In the last 12 months there have been interesting new developments in the area of camera and CCD chips. A novel new technology, the so-called CMOS APS sensors can be very simply integrated into digital circuitry. In contrast to the previous CCD sensors, these picture sensors can be read out like an EPROM. After applying an X and a Y address, the 8-bit value of the picture information is available for the selected pixel. The complicated timing and digitizing of picture data become totally unnecessary. In addition it exhibits superb picture characteristics, such as a very large logarithmic dynamic range of nearly 120 dB (6 light decades) in comparison to a normal CCD sensor with only 60 to 70 dB.

The well-known *blooming* effects of overloaded CCD sensors also disappear. The camera proposed by Peter Gülzow would have a resolution of 512 x 512 pixels with an 8-bit resolution for the brightness information (black/white). The hardware effort is minimal, as is also the interface to the YAHU. The radiation hardness of CMOS APS sensors is exceptionally good at nearly 1 Mrad. Customary CCD sensors have a comparatively low radiation hardness of approximately 10 Krad (Figures 3 & 4).

Originally it was planned to mount two of these cameras on the satellite. One camera on the upper side and the other on the lower side. The idea was to have YACE (*Yet Another Camera Experiment*) film and thus document the separation of Phase 3D after launch. Comparably spectacular pictures have already been provided by TEAMSAT, launched with Ariane-502, which, as it turns out, employed the same camera technology (Figure 5). Due to space limitations we have decided however to mount only a single camera on the upper side. Following separation it will still provide pictures of Earth and also be used by YAHU as a navigation instrument in order to determine the orientation towards the Earth precisely and to correct it with the momentum wheels. A subsequent job could be as star sensor for determining flight orientation, a task that the StrongARM could easily handle. The pictures from the YACE camera will initially be stored in the 8 MB memory of the YAHU. Without compression no more than 32 pictures could be so stored. Appropriate JPEG compression would allow many more pictures, even a film sequence to be stored. The YACE camera is not intended to, nor can it, compete with the SCOPE experiment.

To return now to the YAHU, the command system is compatible with the old IHU and can even use the same command uplink. The downlink and telemetry will likewise be transmitted at 400 Bit/s over the middle beacon (MB). Originally the MB was only intended for the 2m transmitter since the limited bandwidth of the transponder would not support both an engineering beacon (EB) and a general beacon (GB). The MB signal will be generated in the transponder matrix and then fed directly into the IF. Thanks to this fortunate circumstance, we can now use this beacon for YAHU also without having to make any significant changes. Merely one additional wire must be added to the cable harness from the matrix to YAHU. As soon as YAHU is activated upon command via the IHU, it takes control of modulating the middle beacon. Interested parties can thus receive the YAHU telemetry using the same demodulator and software for the 400 Bit/s telemetry from the Phase 3 satellites.

Like its predecessors the YAHU does not contain any ROM and all of its software can thus be loaded or replaced from the ground. The IPS operating system and the operational software will reside in a 128K x 32 x 3 Bit EDAC memory block. The

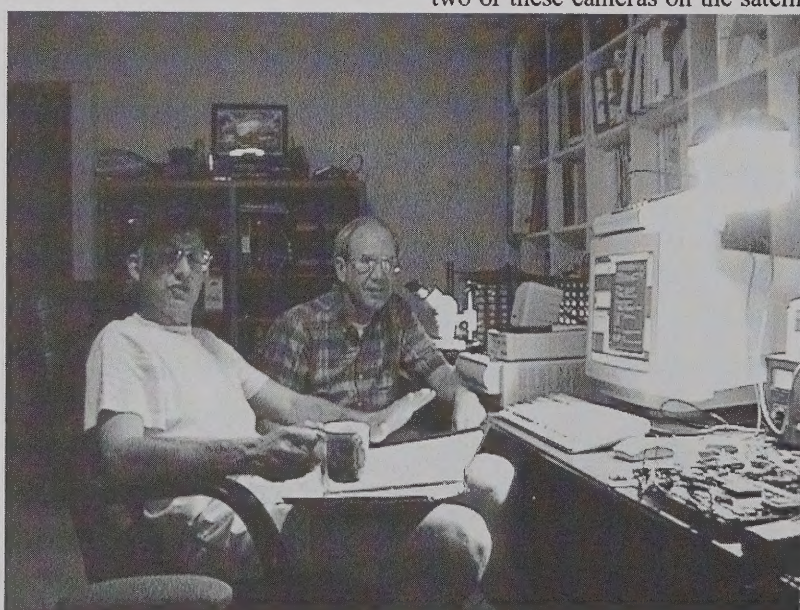


Figure 7. James Miller, G3RUH (l) and Chuck Green, N0ADI (r) during YAHU start-up in Tucson, Arizona. (photo by Lyle Johnson, WA7GXD)

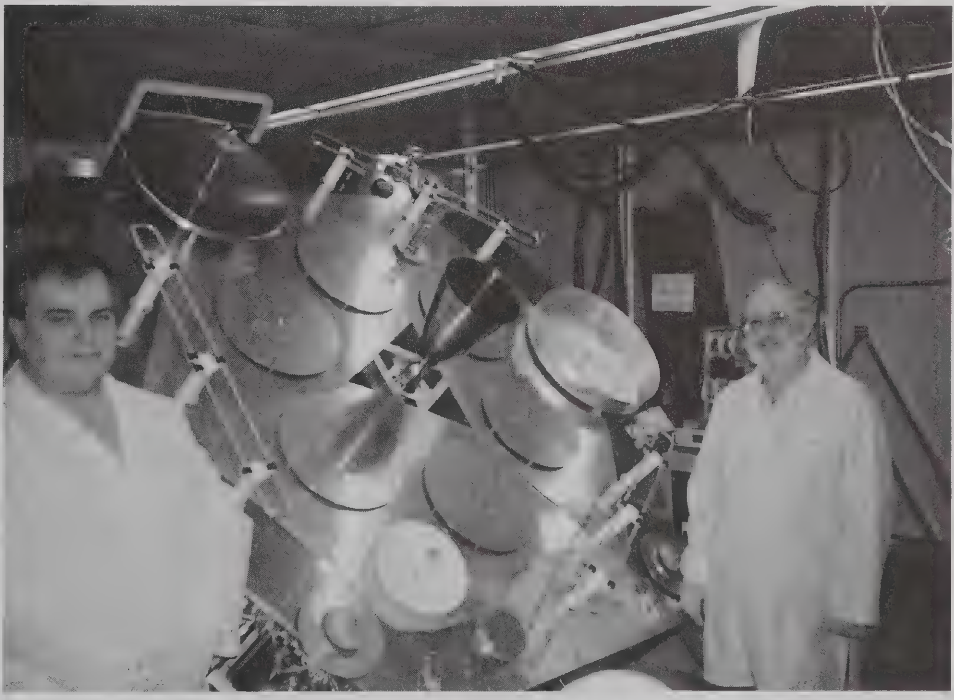
logic for the hardware boot loader is implemented in a FPGA component. Additionally there is also a Flash EPROM of 128 KB which can be written to and erased under software control. The intention is to store a copy of the IPS operating system and the operational software in this flash memory. In order to avoid errors caused by radiation, the contents of the flash memory will be periodically checked and corrected as required. In the case of a computer crash, the command station could restart the computer immediately from the flash memory or reload the entire software from the ground (Figure 6). This technique should prove to be very helpful, particularly under unfavorable link conditions. Additionally 8 MB of unprotected SRAM memory is available for pictures from the YACE camera and other experiments. As already implemented for RUDAK and the various other experiments, YAHU will also have an interface to the CAN bus. This 800 KBit/s local network will allow data exchange between the experiments within the Phase 3D satellite. For example, the pictures from the YACE camera can also be transferred to the generally accessible RUDAK mailbox.

As already mentioned at the beginning, the software for the new YAHU is an important aspect during initial testing of the hardware. James Miller, who as long-term Acorn user, is very experienced with the ARM assembler, took over the development of suitable test software for the initial startup of the prototype and is also working on the important software interfaces for the upcoming 32-bit IPS. Step by step the various functions in the YAHU could thus be tested and put into operation. James Miller also ported the standard IPS (16 Bit version) to the ARM architecture and it is already running satisfactorily in the new IHU-2. ARM development tools are available for other environments, notably the IBM-PC and Sun Workstations. But an IPS environment is presently only available for Acorn Risc Computers. See: *http://www.jrmiller.demon.co.uk/IPS*

By early April 1998 it had progressed to the point where YAHU could send its first block of telemetry data. However, Lyle Johnson still had much debugging to perform on the hardware. Some of the modern components many times did not behave as described in the data sheets so that conversations with the manufacturers were often required to resolve the remaining problems. By the end of April 1998 Lyle Johnson and Chuck Green received additional support from James Miller, who made further software tests and changes on site in Tucson. This saved considerable debugging time, but apparently the nights were often very long and tiring. (Figures 7 & 8)

Figure 8. Lyle Johnson, WA7GXD presenting the YAHU Engineering Unit #1 (photo by Heather Johnson, N7DZU)

As soon as the YAHU prototype operates flawlessly, the next step is to perform a *fit check* in the satellite and to construct the flight hardware. This also signals a major milestone for Karl Meinzer, since he is so enthusiastic over the development of YAHU and the possibilities of the StrongARM SA-1100 that he has promised to write a very powerful 32-bit IPS especially for this RISC processor. This will enable us in the future to perform more complex mathematical computations in the satellite, as would be needed for autonomic supervision and attitude control using the momentum wheels, the camera as well as the Sun and Earth sensors. In short, IPS-32 will optimally exploit the computational capacity of the StrongARM and catapult future satellite projects of AMSAT into the next century. However, until then there is much to do and we will hopefully report on it soon in further detail. ■



Richard Leon, KA1RHL (l) and Lou McFadin, W5DID (r) Phase 3D Integration Laboratory Manager with the final Phase 3D antenna configuration. (photo by Perry Klein, W3PK)

Sun Sensors on Phase 3D

Gerd Schrick, WB8IFM

Editor's Note: This article originally appeared in the the April/May 1998 issue "Anomalous Propagation," the monthly newsletter of the Midwest VHF-UHF Society.

You can argue about what constitutes the most important part of a communication satellite. But there is a consensus, if there is no power, the bird is dead! We all know from AO-13 that the illumination of the solar panels often took precedence leading to poor antenna alignment and the dreaded *spin fading*. It was either that or there would be loss of power and a discharge of the battery.

When AO-10 was launched, the first received telemetry indicated that there was a very low solar illumination; obviously something had not functioned right at deployment. The attitude was so far off that it was out of range of the +/- 45degree sun sensor. So one could only guess at the real attitude and no corrective action (magnetorquing) was attempted. Fortunately, AO-10's situation improved all by itself and cautious magnetorqing began, eventually allowing AO-10 to be stabilized and brought into full sunlight.

This time the Phase 3D satellite is studded with a slew of 16 sun sensors. Of those, two are aligned with the solar cells and are called the *stable mode* sun sensors. Two more additional sensors, also looking towards the sun, are sensing illumination and rotation. And the remaining twelve senors, called the *omni sensors*, are looking *all around*. Three look up and down (in relation to the satellite) for the most undesirable location of the Sun and the remaining six are spaced every 60 degrees looking out to the sides (Figure 1).

A lot of thought and work by a number of people had gone into the design and construction of the sensors. My recent assignment at the Phase 3D Integration Laboratory was a final checkout, including calibration and selection of the proper feedback resistors and an attempt to broaden the pattern for the omni sensors (see the May/June issue of *The AMSAT Journal*). We really wanted *total coverage* and NO drop-outs.

Outputs of the photo diodes are fed to an analog processing board where a multitude of op amps add, subtract and compare before passing the voltages to the IHU. The two *stable mode* sensors are actually small pinhole cameras with one cm square photo sensors. The distance (focal lengths) to the sensors were chosen to create a +/- 45 and +/- 20 degree coverage. This compares to a wide angle and a normal camera lense (for 35 mm photography the corresponding lense would have 22 resp. 60mm lense). The sensor has a transparent resistive layer on the surface and has individual electrodes on all four sides. Below the "P" surface is N-type silicon and a common (metallic) cathode on the bottom surface (Figure 2).

A point of light (the tiny image of the Sun) falls somewhere on the one cm square surface and creates at that point an electrical potential to the cathode. By measuring the four currents from the electrodes to the cathode the position of the sun is calculated. Also calculated are the sums and differences of the two current pairs. This provides an indication (data validation) when the Sun moves off the sensor (Figures 3 and 4).

All the measurements at the Phase 3D Lab are more or less manual and done with love, dedication, and finesse. To ease the stable mode sun sensor measurement we had a fixture mounted on a telescope equatorial mount that follows any heavenly target including the Sun. In essence, the axis of an equatorial mount is aligned parallel to the Earth and rotated with a motor drive counterclockwise at the same rate as the Earth rotates clockwise. Now all we had to do, was set the sun sensor at the desired angles (usually data were taken in 5 degree increments) and read the various currents or voltages. A plotting program for the Macintosh computer did the rest.

The twelve omni sensors use a photo diode which is housed in a TO-5 can. The preliminary measurements of these sensors were made using an *indoor range* akin to a mini antenna range. The sensor was mounted inside a blackened box with only a hole on one side to expose it to an incandescent light source a few feet away. The sensor could be rotated and readings were taken in 5 degree increments. The actual sensor in a TO-5 can is below a window but recessed.

This prevents sunrays beyond about 75 degrees from the normal to enter the sensor's area. We wanted to increase this range at least to 90 degrees and possibly beyond. Since we have plenty of sunlight (light to burn!) we placed a little Teflon dome over the sensor (Figure 5). This dome nicely catches the light from the sides, and we got acceptable readings even beyond 90 degrees (Figure 6). ■

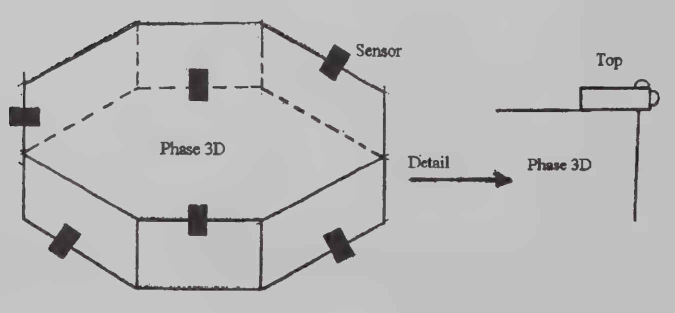


Figure 1. Position of the 12 Phase 3D omni-sun sensors.

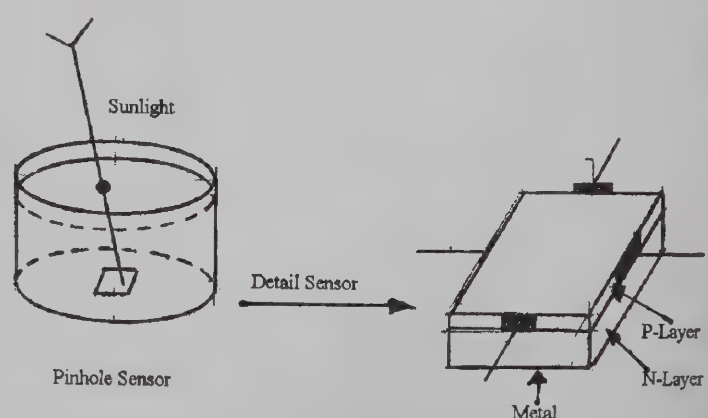


Figure 2. Pinhole sensor diagram.

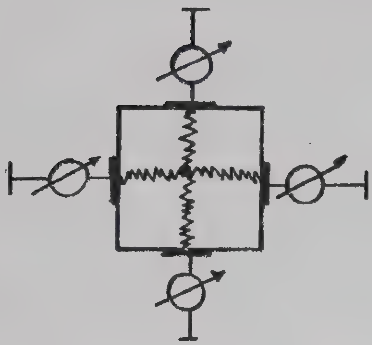


Figure 3.

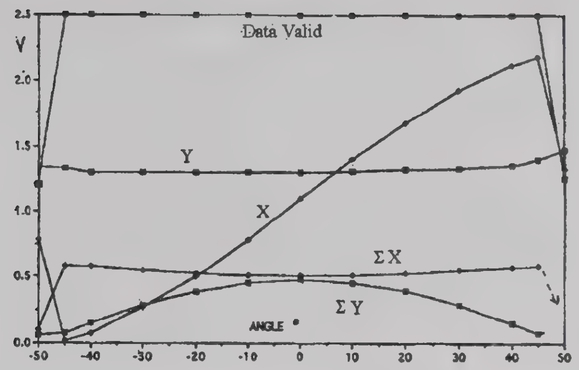


Figure 4. Sun angle and voltage for Phase 3D sunsenors.

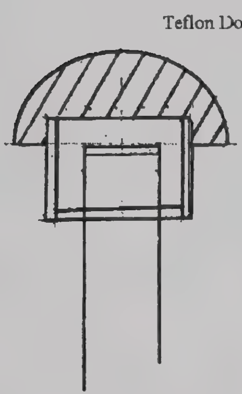


Figure 5. Sun sensor showing teflon dome cover.

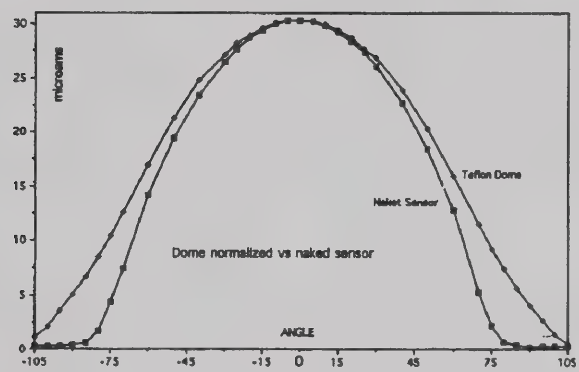


Figure 6. Sun angle to microamps for Phase 3D omni-sun sensors.

Satellite Orbital Elements

Ray Hoad, WA5QGD

Satellite	AO-10	AO-27	FO-20	FO-29	RS-10/11	RS-12/13	RS-15
Catalog Number	14129	22825	20480	24278	18129	21089	23439
Epoch Time	98172.93968049	98190.18671074	98189.11834301	98189.99813008	98190.37851342	98190.52891072	98189.15619545
Element Set	553	652	71	174	508	80	322
Inclination	26.8182	98.4985	99.069	98.5173	82.9233	82.9204	64.8141
RA of Node	82.0236	259.8939	83.7428	182.85	312.5215	351.3796	248.7253
Eccentricity	0.6001096	0.0008291	0.0540094	0.035083	0.0010117	0.0028362	0.0147377
Arg of Perigee	226.7619	179.7643	223.8777	263.4544	225.0739	301.7869	57.0875
Mean Anomaly	64.195	180.3534	131.8207	92.6548	134.9591	58.0523	304.4124
Mean Motion	2.0588061	14.2778381	12.83245036	13.52643804	13.72399197	13.74102101	11.27530119
Decay Rate	0.0000003	0.00000054	0.00000104	0.00000012	0.00000049	0.00000057	-0.00000039
Epoch Rev	11297	24929	39420	9341	55334	37235	14545
Satellite	RS-16	UO-11	UO-14	AO-16	DO-17	WO-18	LO-19
Catalog Number	24744	14781	20437	20439	20440	20441	20442
Epoch Time	98189.28066179	98190.91039455	98189.26594315	98189.12856200	98189.14555838	98190.20219392	98189.15814547
Element Set	225	71	365	167	160	166	172
Inclination	97.247	97.8825	98.4872	98.5102	98.5161	98.5148	98.5199
RA of Node	92.5851	162.7783	266.9169	270.6733	271.8547	272.735	272.6239
Eccentricity	0.0007307	0.001082	0.0010983	0.0011662	0.0011432	0.0012164	0.0012393
Arg of Perigee	133.4219	200.625	146.7189	150.3775	148.3018	146.1857	148.3939
Mean Anomaly	226.7635	159.4517	213.4664	209.8064	211.8857	214.0111	211.7995
Mean Motion	15.36653633	14.69796231	14.30026994	14.30070775	14.30216926	14.30179626	14.30300622
Decay Rate	0.00014658	0.00000561	0.00000008	0.00000073	0.0000008	0.0000008	0.00000074
Epoch Rev	7525	76820	44139	44139	44143	44158	44146
Satellite	UO-22	KO-23	KO-25	IO-26	TMSAT-1	MIR	Phase 3D (est)
Catalog Number	21575	22077	22828	22826	25395	16609	999934
Epoch Time	98189.17476778	98189.70533378	98189.15476005	98189.14406625	98191.87373682	98190.10903400	96260.25520000
Element Set	878	757	630	656	2	622	3
Inclination	98.249	66.0782	98.5	98.5027	98.7944	51.6616	60.0203
RA of Node	239.9086	55.9514	259.3553	259.236	261.8948	295.6027	342.7876
Eccentricity	0.0007106	0.0012046	0.000976	0.0008704	0.0001516	0.000695	0.6752895
Arg of Perigee	168.7093	302.7169	168.4716	186.3368	6.1903	197.9433	180.1221
Mean Anomaly	191.4254	57.2674	191.6697	173.7706	313.0257	162.1367	179.5059
Mean Motion	14.37154333	12.8631001	14.28248224	14.27896666	14.22263117	15.65553896	1.51063698
Decay Rate	0.00000118	-0.00000037	0.00000081	0.00000101	-0.00000045	0.00017429	0.0002
Epoch Rev	36592	27746	21730	24916	9	70749	2

Y2K: The Millennium Problem for Satellite Software

Reinhard Richter, DJ1KM

Translated from *AMSAT-DL Journal* by John Bubbers, W1GYD

Virtually no computer user has escaped the Y2K problem that at the end of this Millennium. I will ignore the details, but each of our readers has read the horror stories. Even satellite software is not free of the problem.

Late in the fall of last year Ken Ernandes, N2WWD, brought the problem to our attention and offered a possible way to check one's own configuration. The problem can affect the hardware as well as the software and the satellite programs.

The concept is to create Keplerian data for a fictitious satellite which has an epoch time for late in December, 1999 and another epoch time for early January, 2000. I have simplified the previous comprehensive contributions of N2WWD, and have made twin satellites out of them, which I also have designated T-1999 and T-2000. Both have the same orbital data, they are differentiated only by the epoch time. Decay will not be taken into account, and has been set to zero. To this extent there are no underlying differences, even over a longer time period. One can imagine it as though MIR is locked in position with the space shuttle and orbiting together. There are two objects with the same orbital data. The Keplerian elements in Figure 1 are printed in NASA2LINE as well as AMSAT format.

How does one proceed with the final test? First, one has to set the computer's date to December 31, 1999 from the DOS level command "DATE" and the time with the "TIME" command to 23:59. Then wait for two or more minutes and enter "DATE" via your keyboard again. If January 1, 2000 appears, you have proceeded forward significantly. Turn the computer off and after a short period of time turn it back on. Check the date again. If January 1, 2000 reappears, consider yourself lucky. If January doesn't reappear, a good guess is that the problem is in the computer's BIOS.

Now enter the real date and time again and load your satellite program. Now enter the Keplerian elements of the two satellites T-1999 and T-2000 into the satellite program to be tested. If you enter these data into a separate file in advance, it will probably be easier to load the data into the program. Possibly your software will indicate a checksum failure; then this will be your first incompatibility. I will send the data electronically to those who contact me via packet (*dj1km@db0fd*) or e-mail (*dj1km@amsat.org*) indicating the keyword Kepler2000. Alternatively, take a look in the PR heading AMSAT where I will publish this article in abbreviated form and the Keplerian elements after the publication of this Journal. Then you can download directly, without having to contact me.

Open your satellite program and track both satellites. They should both indicate the same orbital path, that is, the same AZ and EL values and identical sub-satellite coordinates. It is sufficient to check the latter only, since the other values are derived from them. Probably, equal values for both satellites will not result, since few programs can interpret the epoch time year 2000 correctly. Most programs interpret it as 1900 which results in something completely wrong.

Now you will know that under these circumstances when the Keplerian elements have an epoch time beginning with 2000 that they will not be processed correctly. This is simply because no programmer was able to know exactly how the epoch time beginning in the year 2000 would be presented. Therefore, do not complain about the program's author.

Now we arrive at the super test. Set your date and time, as earlier, to just before the millennium year change, and load in the T-1999 satellite and observe what happens at the millennium change. If the values make a sudden jump, the program cannot handle the millennium year change. The only help is to ask the program's author whether he has an update. If the millennium transition proceeds properly, then the anticipated values for date/time 01-01-2000/00:01:00 should be 6 degrees south latitude, 12 degrees east longitude,

and the altitude is 440 km, all values +/- tolerance.

The test can then be advanced to perform the test for the date/time of 01-01-2001/00:01:00. The year 2000 is a switch year as opposed to a regular full century. Something can happen here as well. Now the anticipated correct values for the sub-satellite position are 65 degrees north latitude, 128 degrees east longitude and the altitude is 450 km, again +/- tolerance.

I have tested all the software programs that AMSAT-DL offers through our sales program as well as many others. Only a few have stood the test, for instance the 16-bit version of *WiSP* by Chris Jackson, G7UPN and *STS Orbit Plus*. I have notified all the other software authors, and they have been asked to update their programs. At publication closing time all the programs by Erich Eichmann, DK1TB (AMSAT-DL, Art.-Nr.107, 116 and 117), the satellite service program by Manfred Maday, DC9ZP (AMSAT-DL, Art. 103) and *Satmaster* by Hans-Hermann Schulze, DB1HZ have accordingly been updated. The STATION program by Paul Willmott, VP9MU is ready for the next millennium. As of this writing, the American program *InstantTrack* has yet to be reworked as well as *WiSP32*. The reworked programs can be ordered from us at the appropriate time with the usual requirements for the corresponding updates. ■

```
T-1999
1 31999U 99001A   99360.00000000  .00000000  00000-0  00000-0 0   101
2 31999  82.0000 120.0000 0150000 270.0000 100.0000 15.50000003  1591

T-2000
1 32000U 99001A       1.25034722  .00000000  00000-0  00000-0 0   205
2 32000  82.0000 113.0636 0150000 247.4755  56.9230 15.50000006  2562
```

Satellite: T-1999		Satellite: T-2000	
Catalog number:	31999	Catalog number:	32000
Epoch time:	99360.00000000	Epoch time:	1.25034722
Element set:	10	Element set:	20
Inclination:	82.0000 deg	Inclination:	82.0000 deg
RA of node:	120.0000 deg	RA of node:	113.0636 deg
Eccentricity:	0.0150000	Eccentricity:	0.0150000
Arg of perigee:	270.0000 deg	Arg of perigee:	247.4755 deg
Mean anomaly:	100.0000 deg	Mean anomaly:	56.9230 deg
Mean motion:	15.50000003 rev/day	Mean motion:	15.50000006 rev/day
Decay rate:	0.00000e-00 rev/day^2	Decay rate:	0.00000e-00 rev/day^2
Epoch rev:	159	Epoch rev:	256
Checksum:	149	Checksum:	164

Figure 1: Keplerian Elements in NASA 2-line and AMSAT Format

1998 ARRL and TAPR Digital Communications Conference
September 25-27, 1998 in Chicago, Illinois
http://www.tapr.org/dcc

It's that time again! Mark your calendar and think about what to publish for the upcoming 17th Annual ARRL and TAPR Digital Communications Conference. This is the third year in which the ARRL Digital Communications Conference and TAPR Annual General Meeting are joined into one conference! The ARRL and TAPR Digital Communications Conference is an international forum for radio amateurs in digital communications, networking, and related technologies, who meet, publish their work, and present new ideas and techniques for discussion. Presenters and attendees have the opportunity to exchange ideas and learn about recent hardware and software advances, theories, experimental results, and practical applications.

The 1998 ARRL and TAPR Digital Communications Conference will be held September 25-27, 1998, in Chicago, Illinois. This year's conference location is the Holiday Inn Rolling Meadows, just minutes from O'Hare Airport. Full information on the conference and hotel information can be obtained by contacting Tucson Amateur Packet Radio, 8987-309 E. Tanque Verde Road #337, Tucson, AZ 85749-9399, telephone 940-383-0000, fax 940-566-2544, e-mail *tapr@tapr.org*, browse *www.tapr.org/dcc*.

ARRL and TAPR especially welcome papers from full-time students to compete for the third annual student papers award. Two $500 travel awards may be given, one in each of the following categories: a) best technical/theory-oriented paper by a student, and b) best educational or community-oriented application paper by a student. The paper should relate directly to a wireless digital communication topic (see the guidelines for more information). Papers co-authored by educators or telecommunications professionals are also eligible for this award as long as a student is the first author. Please note that this deadline is different from the general conference paper submission date. For full details and paper guidelines contact TAPR or browse to *http://www.tapr.org/dcc*. ■

A Common Date/Time Standard for Amateur Radio

Ian Galpin, G1SMD, QTHR. *(g1smd@amsat.org)*

This article introduces a subject that may already be familiar to some readers - the adoption of a common Date and Time format for use within all radio operations both 'on-air' and 'off-air'.

The proposal applies to: computer program screens, data files, log books, QSL cards, satellite predictions, magazines, e-mail messages and data, packet messages, contests, written text, award certificates, transmitted telemetry data, Web Pages, newsletters - in fact anywhere that dates and times are used.

The 'satellites' part of the vast hobby covering Amateur and Short-wave Radio, is closely allied with some branches of Astronomy. Astronomers have already been using a common date and time format for the last 200 years or more; bringing a consistent, simple, and unambiguous style to astronomical computer programs, and to published tables of astronomical data. This has reduced misunderstandings and confusion when data and messages containing dates and times are transferred around the world.

It is proposed to adopt several closely related formats within Amateur Radio. These are described below.

Calendar Date

Firstly, the 'full' format for Gregorian Calendar Date, as defined in International Standard ISO 8601. This requires that dates are simply written using all four digits for the year, use the order Year-Month-Day, and have a leading zero for month and day numbers between 01 and 09. That is, today's date (June 10th) is written '1998-06-10'.

ISO 8601 only covers dates that are fully numeric. Astronomers often use an unofficial variant. They write dates in the same Year-Month-Day order as in the standard, but with the month either as the 3-letter English abbreviation or else written out in full. So '1998-06-10' becomes '1998-Jun-10' or '1998-June-10'. These are considered to be clear and acceptable methods, and are also proposed for use within Amateur Radio.

Ordinal Date

The other date format to be included in the proposal is the 'Ordinal Day of Year' ('Ordinal Date') definition. This ISO format requires a 4-digit year followed by the 3-digit day number in that year (001 to 365; 366 in a leap year). Today (June 10th) is '1998-161', the 161st day of the year 1998. The last day of last year is written as '1997-365'.

In both of the date representations above, the hyphen separator '-' is normally used between elements. The oblique '/' has another meaning within the standard and should ***not*** be used in dates. For data storage, the separators can simply be removed. So, '1997-12-31' can be stored as the 8-digit number, or string, '19971231' and similarly '1998-161' can be stored as the 7-digit '1998161', for example.

A shortened version of the 'Ordinal Date' format is already used in satellite Keplerian elements. This has only 2-digits for the year, and does not normally include the hyphen separator; hence '97365' and '98161'. Expansion of the year part to four digits is recommended.

Times

The Amateur Radio proposal also covers the representation of Time. It merely adopts the definition from ISO 8601, which is to use the 24-hour system that we have already been using for many years. It specifies that times are written in the order 'Hours:Minutes:Seconds', and that in each field the digits '00' to '09' have a leading zero. The colon ':' separator is used when displaying or printing times. For data storage the colons can be removed. In this way, '20:44:59' becomes '204459', in a similar way to the treatment of dates above.

When combining dates and times, the date should always be written before the time. Some people also put the Day Name between the date and the time as in '1998-06-09 Tue 20:44:59'. This isn't defined in the ISO standard, but since it doesn't interfere with the general left to right precedence that runs across all the elements Year-Month-Day followed by Hours:Minutes:Seconds there is no real problem in doing this for display purposes.

Time Zones

The last part of the proposal is concerned with the representation of Time Zones. Amateur Radio, much like astronomy, mostly uses the 'UTC' time zone. The ISO 8601 standard states that this should be denoted by the letter 'Z'. Many people are more familiar with 'UT' or 'UTC'; I propose that any of these methods be used. Often in astronomy, 'UT' is used for Universal Time and 'LT' is used to denote 'Local Time'. In Amateur Radio, if the Zone isn't explicitly stated then it is generally assumed to be a date and time in UTC. This should continue.

For zones other than UTC, the ISO standard differs greatly from the established radio-hobby methods. We usually use 3-letter abbreviations, such as 'EST' (for 'Eastern Standard Time'). However, not all zones have an associated abbreviation, and many of the abbreviations (especially for those zones outside of the US and Europe) are not well known internationally.

The ISO method uses a 'sign and 4-digit representation' such that EST, which is 5 hours behind UTC, is shown as '-0500'. India is 4 and a half hours ahead of UTC and is shown as '+0430'. This method is common on the Internet, and on stored data, but virtually unknown in the amateur and short-wave radio hobbies.

The Amateur Radio proposal leaves it up to you which method to use. There are times when one or the other may have a clear advantage. It is noted that the UTC time zone is already used for most data, and that this should continue whenever possible. Some computer programs may wish to show both UTC and Local Time on screen at the same time. In this case, the '+0830' method for indicating the time zone can give a simple and convenient reminder of the offset employed.

Other Formats

Not mentioned in the proposal document is the 'Julian Day' representation; a simple count of days starting at 'BC4713-Jan-01'. This is regularly used in astronomy, and in some satellite programs. Another method, is

where the Time of Day is expressed as a decimal fraction of the day - '18:00:00' being '0.7500' for example. There is no problem with either of these methods continuing to be used for the specialised purposes that they usually apply to. The proposal mostly addresses removing the most contentious and ambiguous methods from regular usage. In particular, the proposal seeks to **phase out:**

- 2-digit years, because they cause problems to computers and to historians.
- the ambiguous 'dd/mm/yy' and 'mm/dd/yy' ordering.
- usage of 12-hour am/pm clock.
- usage of Local Time.

The proposal seeks to **standardise on:**

- 4-digit years.
- full left to right precedence across data elements of all types with the Year on the left, down to Minutes and Seconds on the right.
- consistent data-length, using leading zeroes on digits '00' to '09'.
- 24-hour clock for times.
- usage of UTC as the standard time zone for all work.

The ISO 8601 document also contains the correct definitions for Leap Years (2000 is, 1900 was not!). It also mentions various date formats based on Weeks of the Year and Days of the Week, and for expressing periods of time. These aren't especially relevant to Amateur Radio. They are not included in the proposal. The ISO 8601 standard also defines that a combined date and time should be separated by the letter 'T'. This mainly applies in computer protocols and data interchange formats. On computer screens and printouts, most people prefer to show dates and times as two separate items separated by one or more spaces. I recommend that later option.

Implementation of ISO 8601

Every European country has now implemented the EN 28601 standard (the EuroNorm version of ISO 8601). The US has adopted the Year-Month-Day format: see the ANSI X3.30 standard. This is also endorsed by NIST (See Document FIPS 4-1). In Japan, see the JIS X 0301-1992 standard. Many other countries around the world have also adopted the original ISO 8601 standard.

A number of US software producers (including several well known Amateur Radio products) having realised that the '12/31/98' format is often confusing outside of the US, are now changing to the new format in their work. This is also recommended by IBM and many others, as part of the cure for the 'Year 2000 Problem'. See IBM Publication GC28-1251-06 *The Year 2000 Guide*, and later issues (latest issues is 08: 1998-Feb).

The benefits of the new method will be best seen soon after '2001-01-01'. Other systems will show '01/01/01', then either '02/01/01' (in UK) or '01/02/01' (in US) the following day. Under the ISO scheme, the day after '2001-01-01' is '2001-01-02'. Some people prefer the '2001-Jan-02' alternative.

Year 2000

The formats described in ISO 8601 are being extensively used in solving the 'Year 2000 Problem' with computer software. With a 4-digit year there is no problem with computer math involving dates - unlike those that can occur if only a 2-digit year is used and the dates are in different centuries: 2005 minus 1995 = 10 years, but '05' minus '95' = minus90.

In addition, many algorithms dealing with dates can be made much simpler. In comparing two dates in 'ddmmyyyy' format, each date has to be cut up into Year, Month and Day elements and each element is then compared in turn. Even though '31121999' is a larger number than '24122001' it is not the later date. Using the 'yyyymmdd' format, which yields dates like '19991231' and '20011224', now means that the larger number is always the later date.

Programs based on this logic will often run faster as the date comparison can now be done in only one simple instruction, rather than requiring a whole sub-routine.

As time marches on, a 2-digit year solution quickly expires. The 'Year 2000

Problem' with computer systems occurs where 2-digit year dates are assumed to be '19xx' dates: '00' is 1900 and '99' is 1999. The SGP4 and SDP4 models, on which many Satellite Tracking programs are based, have coding that may cause them to expire, or produce wrong results, after the end of 1999. You may assume that a track for '1.1.00' is for 2000-Jan-01, but the program may be showing you where the satellite would have been on 1900-Jan-01!

Alternatively the program may assume that Year '00' elements are for 1900, and use this as the basis of the calculation to show you where the satellite is just over 100 years later, in Year 2000. Whilst someone may re-write these programs to correctly handle the years 2000 - 2099, if they retain the 2-digit year format you won't be able to do any 'back-tracking' for '19xx' dates using the new programs.

In 2057 it will also be impossible to tell if Year '57' Keplerian elements are for 1957 or 2057, leading to other errors (the first satellite launch was in 1957). NORAD have indicated that they don't intend to address this part of the problem until much nearer 2057. The roll-over from '99' to '00', however, needs immediate attention. Programs need to know that element sets from '57' to '99' represent '19xx' years, and that '00' to '56' are for '20xx' years. If the rest of the program then works with a 4-digit year at all stages, these problems can be overcome.

The writing of dates on screen and on printouts using a 4-digit year and the proposed Year-Month-Day method also removes the long standing confusion when dates are passed across the Atlantic. Many people have received QSL cards for a contact on, say, '5/8/94' but could not find the QSO in the log book. Eventually it is discovered on the '8/5/94' page. Computer programs sometimes cause confusion when dates appear to be 'backwards', the day and month fields being reversed from the way we are normally used to working.

The ISO format, in putting the year first, ensures that '2003-02-01' does not look like '01/02/03' or '01/02/2003' and cannot be confused with either of them. With a 2-digit year, it is unclear whether '03' means 1903 or 2003; and the latter two examples also have a different meaning depending on where you live ('1st February' in UK, or 'January 2nd' in US). The date '2003-02-01' always means '2003 February 1st', so avoiding both problems.

For many, the change to the new date format can be made at the same time as any Y2K work is carried out; Y2K work mainly being an expansion of all year information from 2-digits to the full 4-digit representation. As it will take some time for new versions of programs to reach users all round the world, work on ISO 8601 and Y2K reprogramming should begin immediately. This justifies a 'major' revision number increment, especially so if it is also the first version of your program that will handle the Year 2000 correctly (e.g. from Ver 4.3 to Ver 5.0 as in the case of the new OH5IY meteor scatter software).

Most of the Year 2000 Diagnostic Programs are already using the ISO date and time format; as can be seen in products from RighTime Inc (USA), Saphena (UK), IBM, and many others.

The proposal can be adopted by a whole range of people. Here is how it can apply to the various aspects of Amateur Radio:

Software Writers

Add the Year-Month-Day format to the available options in your software, preferably making the new format the default option. To reduce the amount of programming required, some people have already decided to make it the *only* format that their program uses. Use this format on screen and on printouts, as well as in data storage and interchange. Use it also in the program documentation. Remember to show dates before times; and to always use the full 4 digits for the year. Do not use a 2-digit short-hand.

Computer Users

If available, select the 4-digit year, Year-Month-Day, and '24-hour clock' options in all of the software packages that you are using. It is already possible to use the ISO date format on some Amateur Radio software. Check the user documentation of the program to see what is available. Run the computer clock and all software in the UTC time zone, to eliminate confusion over time zone differences.

Some US users may find the change from '08/28/98' to '1998-08-28' or to '1998-Aug-28' a bit of a culture shock, at first. However, the new format does retain the Month/Day ordering that US users are already used to. On a global scale, many people are already comfortable with the new format. It is in daily use in many other countries, mainly due to its logical and unambiguous meaning.

DOS (Version 5.0 or later)

Add the line 'COUNTRY=086' in the CONFIG.SYS file. Note that the 'DIR' command will still only use a 2-digit year. However, many programs (e.g. Norton Utilities Version 4.50 etc) will pick up the new country information and start working in the Year-Month-Day format automatically.

Programs like 'GeoClock' already use this format, and have done so right from their earliest versions. In Europe many people are moving from their old '28/08/98' format to the new style. Many countries in Scandinavia, Eastern Europe, and Asia have been using the Year-Month-Day format for years. A list appears in the 'International' section of the DOS 6.22 reference manual, for example.

Windows 3.x

For users of Windows 3.x, 95, NT4 and 98, look at the options available in the 'Control Panel'.

In Windows 3.x look at the 'International' Settings. In 'Date', click on 'Change'. In the 'Short Format Date' box, select 'YMD', Hyphen Separator, 'Show Century', 'Month Leading Zero' and 'Day Leading Zero'. In 'Long Format Date' select 'YMD'; then use the pull down options to select a 4-digit year, 3-letter month, and leading zero on the day number. Finally, click on 'OK'. In the 'Time Format' option ensure that '24-hour' is selected, and that a leading zero is shown for digits '00' to '09', then click on 'OK'.

Windows 3.x Year 2000 Bug

The File Manager contains a bug such that when dealing with dates after the end of the year 1999, the dates are displayed incorrectly. For a 2-digit year, 2000 is displayed as ':0' (colon zero), 2001 as ':1' (colon one) and so on. From 2010 onwards the colon changes to a semi-colon; 2012 being displayed as ';2' for example.

For a 4-digit year, the last two digits are shown as described above. The first two digits are fixed as '19'. That is, 2005 is shown as '19:5' and 2016 is shown as '19;6'. There are fixes available from the Microsoft Web Site. One file is for Windows Version 3.1, another is for the Windows For Workgroups Version 3.11 programs.

This date corruption problem occurs due to the way that the program was written (usually in Assembler). The ASCII characters after 7, 8, 9 are ':' then ';' and so on. In effect when 'colon zero' is shown, the program is trying to display 'ten zero'. This problem also occurs on some Amateur Radio programs (both DOS and Windows) as documented in QST, 1997-Aug, Page 69 and 70. The shareware program 'List' by Vernon Buerg also has this problem in all versions issued from before 1983 to current issues dated 1998.

Windows 95, NT4, 98 and etc.

Under Windows 95, NT4, and 98 look at the 'Regional Settings' option of the 'Control Panel'. First, select the 'Regional Settings' tab. Ensure that the correct country and language is shown (the default is usually the 'United States') else select the correct one from the drop-down list, and click on 'Apply.'

In all further stages here, several options are available in the drop down boxes on screen. If the option that you want isn't listed, just go to the main box where the definition is shown and type the new definition in, in place of the one already there.

Next, select the 'Date' tab first. In 'Short Date Style' select 'yyyy-MM-dd' (this will give the '1998-10-11' format in programs). In 'Long Date Style' select 'yyyy-MMM-dd' (for '1998-Oct-11') or 'yyyy-MMMM-dd' ('1998-October-11'). If you also wish the Day Name to be shown then append ', ddd' or ', dddd' to the end of the Long Date Style entry. Click on 'Apply' and then select the 'Time' tab. Change the Time Format to 'HH:mm:ss' to give the standard 24-hour system, then click on 'Apply'. Finally, click on 'OK'.

You may also wish to click on the 'Date/Time' icon. Check that you are set for the correct Time Zone; though most people prefer to set it to UTC (GMT). Click on 'OK' to finish.

Acorn RiscPC

For users of the Acorn RiscPC series of machines (especially those running RiscOS 3 onwards), full details of how to select the Year-Month-Day format are contained in a document recently written by G3RUH. This includes a new 'Filer' template. It is available as a 'ZIP' file, from the G3RUH Web Site on Internet, at: *http://www.jrmiller.demon.co.uk/rpc/*. This file is also linked from my own Web Page. For Packet Radio users, look for the file 'RISC-ISO.ZIP' on the various 'CLIVE' servers, 'reqfil', and elsewhere.

Other Systems

Other operating systems may also allow the Year-Month-Day format to be used. Consult the appropriate operations manual for details. As a bare minimum, ensure that you try to use the full four digits for the year wherever possible.

Editors and Writers

For editors of magazine columns and features, people writing email or packet messages, collating information, or designing Web pages on Internet: Simply ensure that dates are written in the '1998-09-10' or '1998-Sep-10' or '1998-September-10' format (rather than the ambiguous '9/10/98' or '10/9/98' style). Use the new format in band reports, rally calendars, events diaries, messages, and so on. Will that date be equally readable to all your readers all over the world? Stop and think before writing something that may be misread by some.

Usage of ISO 8601 in Amateur Radio

The Meteor Scatter (MS) section of Amateur Radio is already familiar with the ISO 8601 format. It is used in the popular MS software by OH5IY, and in the MS Reports, Es, and Aurora sections of the German DUBUS magazine. The latest version of the EME software by VK3UM now uses this format. Most astronomy programs and journals have always used formats that are very close, if not identical, to the ISO 8601 format.

Many, but not all, amateur radio satellite-tracking programs allow the Year-Month-Day format on screen. G3RUH has used this format for many years; recently also joined by G3SEK and G0RUR. Many datacomms packages already allow this format to be used (though some only allow a 2-digit year). It is expected that the ISO format will be the default style across most amateur radio software packages by the time the Year 2000 arrives.

In Britain, the *Four Metres News* newsletter published by G3NKS has recently adopted the new format, as has the *CQ-TV* magazine and Web Pages of the BATC (British Amateur Television Club). A 'Date and Time' document with further information and references can also be found on the BATC Web Site. The RSGB *Microwave Newsletter* is also changing to the new format in the near future. A number of other publications are in the process of adopting the new format. It is also used in the official IARU DX Records Tables maintained by GM4ANB. It was used to good effect in QST (ARRL, USA) in the 1998-May issue, on Page 86.

The internal workings of the AX.25 Packet Radio system are generally based on the Year-Month-Day format (but mostly only with a 2-digit year at present). It is highly recommended to extend the year to 4-digits, whilst retaining the Year-Month-Day date format. At the end of 1999, Packet Radio will roll over from '991231' to '000101'. Has anyone investigated what happens with Year '00' data that arrives at a place still in Year '99', or vice versa? Just a thought. There may also be an impact on the data formats used in satellite telemetry in a similar manner.

Many Amateur Radio contest rules already call for entries to use the Year-Month-Day format on any computer generated logs. This format is also specified in two recent standards defining Amateur Radio data storage formats. These are the ADIF standard written by WN4AZY and WF1B, and the REG1TEST format devised by OZ1FTU and OZ1FDJ. This proposal is intended to extend the usage of this method to computer screens and printouts, Web Pages, email messages, magazine articles and data, even on hand-written material (such as on QSL cards).

Amateur Radio already has many standards. Those for defining band-plans, transmission modes, call-sign allocations, even the Q-codes and CW abbreviations. We already use a common time zone - 'UTC'. This proposal is purely a suggestion that we all write dates and times in a clear, simple and unambiguous manner. We can do this by adopting the same methods in use by astronomers for the last 200 years and the best parts of the ISO 8601 standard.

This solves both the Year 2000 Problem and the UK / US ambiguity in one go. It has already brought great benefits of consistency and clarity to astronomical texts, tables, programs and data. For programmers it will also make date-related computer algorithms much shorter and simpler. This may make some programs smaller and run faster.

Some existing radio-related computer programs have a menu option to set the date format to be used on the screen - either 'UK' (dd/mm/yy) or 'US' (mm/dd/yy). This is all very well, but you still need a common format for data exchanged between programs or printed out by that program; you don't know who is going to read it.

Take, for example, a log book program that can also print QSL cards. On screen it may say '10/5/98', but what date format are you going to use on the card? Hopefully the 'International' (yyyy-mm-dd) format. So, why not then take this a stage further? Why not make the whole program work in only that one format, completely do away with the 'date format' menu-option, and all the redundant underlying code used to print the date in lots of different and ambiguous ways? Use the ISO format for storage, display and printing. This is how many astronomical programs work - one fixed format throughout, the ISO format.

No action is needed for the ISO 8601 time format - we are already using it: 'hh:mm:ss'. Imagine the chaos there would be if some countries used 'ss:mm:hh', others 'mm:ss:hh' for times. What would a time like '10:05:08' then mean to different people around the world? For dates, ISO 8601 replaces 'dd/mm/yy' and 'mm/dd/yy' with 'yyyy-mm-dd'. This has the same left to right precedence as already in use for time.

Referring to the ITU (International Telecommunications Union) Web Page at: *http://www.itu.int/* reveals that the ITU is already using the new format, as are many other European-based agencies and government bodies. Many US government departments are now starting to use it, especially NIST. The Web Site of the US computer magazine 'Byte' is being changed to use the Year-Month-Day method rather than the old US 'mm/dd/yy' format. Many other organisations and corporations around the world are adopting the new method. This is usually most apparent in the format used on their Web Pages. As these may be read anywhere in the world, an unambiguous format is required.

Supporters

The Amateur Radio proposal is already supported by: G3RZV, G6CGQ, GM4ANB, DL4EBY, DL8LAQ, G3XWH, G3RUH, G4NJH, G8IQU, HB9MAO, AA7BQ, N3EQF, KP2BL, WN4AZY, W1UD, W3IS, G8EXV, G0RUR, GM3JZK, G4IFB, N0ED (G3SQX), G3SEK, G0CUZ, G7LFC, 9M2CR, OH5IY, DL5BCU, G3TZO, G3OAF, G0BAF, VK3UM, G3NKS, G3PHO, and many others. They are already using the

new format in their software releases, writings and Web Pages.

Additional Information

The proposal document has already been circulated around RSGB, ARRL, AMSAT, and IARU. Further information about the proposal, and on other ISO 8601 and Year 2000 issues, can be obtained from many places. Some of these are listed below.

Magazines

- *DUBUS* (Germany), Vol 26 No 1, 1997-Q1, Pages 83 to 85: Proposal Document.
- *Communications of the ACM* (USA), Vol 40 No 5, 1997-May, Pages 26 to 30 and Pages 111 to 117.
- *The Software Practitioner* (USA), Vol 7 No 3, 1997-May/Jun, Pages 1 to 5 (various articles).
- *Byte* (USA/Europe), Vol 22 No 7, 1997-Jul, Pages 89 to 96: 'Double Zero'.
- *QST* (ARRL, USA), Vol 81 No 8, 1997-Aug, Pages 69 to 70: Amateur Radio Software Traps.
- *New Scientist* (UK), Number 2107, 1997-Nov-08, Page 59: 'Last Word on Y2K'.
- *CQ-TV* (BATC, UK), Issue 180, 1997-Nov, Pages 9 to 11.
- *OSCAR News* (AMSAT-UK), Issue 128, 1997-Dec, Pages 37 to 40.
- *Monitor* (ISWL, UK), Vol 46 No 12, 1997-Dec, Pages 493 to 494.
- *Datacom* (BARTG, UK), 1997-Winter, Pages 12 to 16.
- *CQ-TV* (BATC, UK), Issue 181, 1998-Feb, Pages 75 to 77.
- *OSCAR News* (AMSAT-UK), Issue 129, 1998-Feb, Pages 38 to 43.
- *Four Metres News* (UK), Issue 14, 1998-Mar, Page 10.
- *Microwave Newsletter* (RSGB, UK), 1998-May, Pages 10 to 11.
- *Computer Shopper* (UK), Issue 124, 1998-Jun, Page 616.
- *Remote Imaging Group Journal* (RIG, UK), 1998-Jun, No 53, Pages 37 to 41.
- *Datacom* (BARTG, UK), 1998-Summer, Pages 16 to 20.
- *OSCAR News* (AMSAT-UK), Issue 131, 1998-Jun, Page 3.
- *VHF Communications* (G6IQM, KM Publications, UK), Vol 30, 1998-Q2, Pages 82 to 83.
- *CQ-QSO* (UBA, Belgium), 1998-Jul?, Page .?.
- *QST* (ARRL, USA), Vol 82 No 8, 1998-Aug, Page 92: Digital Dimension.
- *CQ-TV* (BATC, UK), Issue 183, 1998-Aug, Page .?.
- *RadCom* (RSGB, UK), Vol. 74, No. 7, 1998-Jul, Page 69: QSL

Longer Items

- IBM Publication GC28-1251-xx, Year 2000 Guide (xx = edition number - latest is 08:1998-Feb).
- International Standard ISO 8601:1988.
- American Standard ANSI X3.30-1985 and NIST FIPS 4-1.
- EuroNorm Standard EN 28601:1992.
- Japanese Standard JIS X 0301-1992.
- A standards list is at: *http://www.aegis1.demon.co.uk/y2k/isoimp.htm*.

Internet

- Send an email message as follows: TO: *info@arrl.org* SUBJECT: Leave 'Subject' blank In the message text, put the following on 3 separate lines:

send index.txt
send g1smd.txt
quit

An automatic response will return the requested files within minutes.

- Search for files by name at: *http://ftpsearch.unit.no/*.

Packet Radio

- Files Y2KHAM.ZIP, G1SMD.ZIP, IAU-FWG.ZIP and RISC-ISO.ZIP from the GB7PFT 'CLIVE' server on AX.25 Packet Radio in the UK. These files may be available by 'reqfil' elsewhere.

Contact Details

You may contact the author by Internet e-mail at: *g1smd@amsat.org* or by paper mail to the Callbook address (1985 to 1998). Also see *http://www.qrz.com/* for the latest listing. ■

WWW Information on the Date and Time Standard

- An Introduction to using ISO 8601 in Amateur Radio: *http://www.batc.org.uk/batc-iso.htm*
- The Amateur Radio Proposal Document: *http://www.kirsta.demon.co.uk/iso_8601.htm*
- Setting up Various Computers for the ISO 8601 Format: *http://www.aegis1.demon.co.uk/y2k/iso-pc.htm*
- Background Notes on the Year 2000 Hardware Problem: *http://www.newscientist.com/ns/971108/letters.html*
- A Short Summary of the ISO 8601 Date Format: *http://shell.ihug.co.nz/~hermetic/cal_stud/formats.htm*
- A Complete Description of the Full ISO 8601 Standard: *http://www.ft.uni-erlangen.de/~mskuhn/iso-time.html*
- Information on the ISO 8601 Standard:*http://www.mcs.vuw.ac.nz/Technical/SGML/doc/iso860 1/ISO8601.html*
- Campaign for Using the ISO 8601 Date Format on Internet: *http://www.saqqara.demon.co.uk/datefmt.htm*
- Examples of Using the Various ISO 8601 Formats: *http://www.jat.org/jtt/datetime.html*
- The IBM Year 2000 Guide (GC28-1251-xx): *http://www.s390.ibm.com/stories/tran2000.html*
- Links to Various ISO 8601 and Year 2000 Resources: *http://ourworld.compuserve.com/homepages/dstrange/y2k.htm*
- Year 2000 and ISO 8601 Information and Links: *http://www.aegis1.demon.co.uk/y2k/y2k.htm*
- Year 2000 Diagnostic Software (ViewCMOS.EXE/Year2000.EXE): *http://www.rightime.com/*
- Year 2000 Diagnostic Software (DOSCHK.EXE): *http://ourworld.compuserve.com/homepages/saphena/year2000.h tm*
- A Guide to The Year 2000 for Amateur Radio Operators: *ftp://ftp.funet.fi/pub/ham/misc/g1smd.zip*
- Replacement ISO 8601 Template File for Acorn RiscPC (G3RUH): *ftp://ftp.funet.fi/pub/ham/misc/risc-iso.zip*
- An Example of a US Corporation Adopting ISO8601 *http://www.atex.com/y2k/y2kstandard.htm*

Field Ops Update: Dayton Hamvention Highlights

Barry Baines, WD4ASW (*wd4asw@amsat.org*)

AMSAT experienced a very successful 1998 Dayton Hamvention. Despite the lack of amateur radio satellite launches in 1998, interest in the Amateur Radio satellite program was very high with attendees seeking out a variety of merchandise items and information from our volunteers who manned the AMSAT booth.

Much of the success of Dayton Hamvention can be attributed to the hard work and dedicated effort of people that occurred before Hamvention as well as by those at the Hamvention itself. AMSAT had available a number of publications that were updated and printed for Hamvention. Through the efforts of various authors, newly revised resources included:

- *The Digital Satellite Guide* that was updated by Steve Bible, N7HPR, now includes installation and setup instructions for WiSP.
- *The Analog Satellites Operating Guide* by Gould Smith, WA4SXM, replaces the earlier RS Satellite Guide and now includes information on AO-10, FO-20, FO-29, AO-27, MIR as well as the RS birds. Gould drove to Dayton from his home in Knoxville, TN to specifically deliver the new books, arriving at the Hamvention on Saturday morning and then returning to Knoxville that evening.
- *Working the Easy Sats* by Gary Rogers, WA4YMZ was updated by Mike Seguin, N1JEZ.
- *How to Use the Amateur Radio Satellites* by Keith Baker, KB1SF, is now in its seventh edition (1998-1999).
- *The Amateur Satellite Resource Guide* by Gary Rogers, WA4YMZ was updated by Mike Seguin, N1JEZ.
- *The AMSAT Frequency Chart* was updated by Bill Tynan, W3XO with laminated copies available at the booth.

A key success this year was the idea of offering the very popular *Arrow Antenna* at the AMSAT booth. Keith Baker, KB1SF, contacted Allan Lowe, N0IMW, of Cheyenne, WY in late March to see if Allan would be interested in allowing AMSAT to take his satellite antennas on consignment at the AMSAT booth. Allan readily agreed to the arrangement, and plans were made for AMSAT to pick up their stock from his flea market spot on Friday morning of Hamvention. By mid-morning on Sunday, all 35 antennas (including duplexers) were in the hands of hams who were planning to use them on AO-27 and other satellites.

As of this writing in mid-June, no decision has been made as to whether AMSAT will continue to offer the antenna. While we've been very successful at a relatively large

Bdale Garbee, N3EUA, discussing RUDAK during Friday morning's AMSAT forum. (AMSAT-NA photo by Keith Baker, KB1SF)

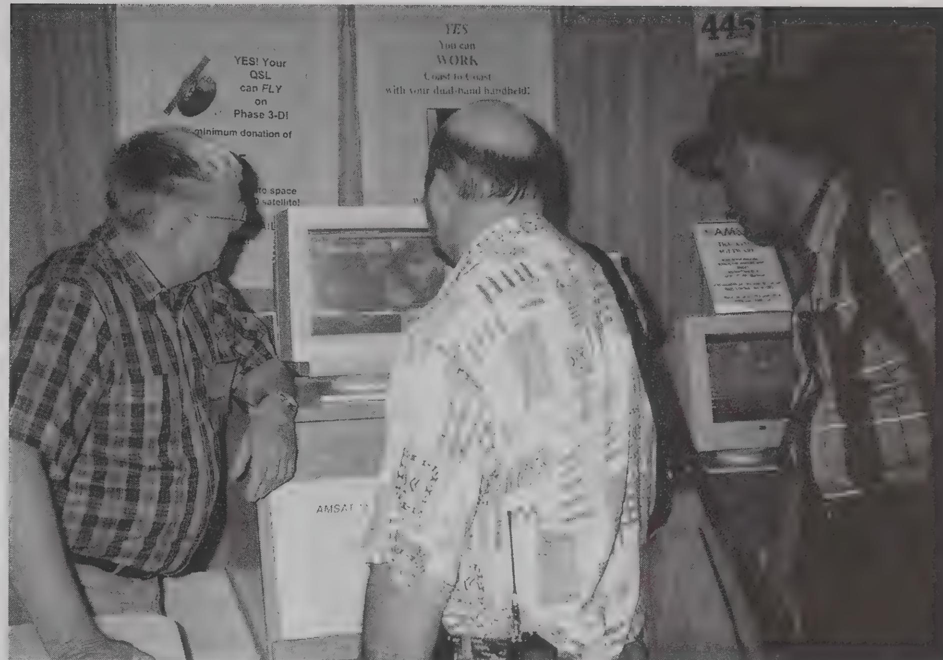
Matt Bordelon, KC5BTL discusses SAREX and International Space Station during Friday morning's AMSAT forum. (AMSAT-NA photo by Keith Baker, KB1SF)

gathering, it is not clear whether it makes sense to ship these antennas to other hamfests or perhaps simply take orders. AMSAT wishes to thank Allan Lowe, N0IMW for his strong support.

Booth Activities

Booth setup occurred on Thursday. A number of volunteers were available to help unload the rental van containing the booth equipment that is stored in Dayton as well as handle the large number of boxes that were either shipped to Dayton or hauled in the automobiles of Howard Ziserman, WA3GOV and Bob Carpenter, W3OTC from Silver Spring, MD. The logistics of Hamvention are extensive, with the exhibit covering four booth spaces, four computer systems displaying software and a APRS/MIR demonstration , a VCR with TV monitor (displaying a video on Phase 3D Integration professionally prepared by Terry Douds, WB8CKI utilizing stock footage by KB1SF and W3XO), membership information available on a separate computer (W3OTC transported the AMSAT office computer to Dayton), and various posters highlighting the *Fly Your QSL* campaign and the Arrow Antenna. Given the very warm weather that Dayton experienced along with the lack of air conditioning, we were careful to stock plenty of cold drinks, ice, and snacks for our volunteers.

A key ingredient was the corps of volunteers who stepped forward to help man the booth. A "help wanted" bulletin was released by WD4ASW on April 27 to AMSAT-BB requesting assistance in manning the booth with a request that members identify when they wanted to work the booth, what skills they have with various software, and other considerations that they might have. Based upon the responses received to that request, work schedules were developed and forwarded to 25 volunteers via e-mail the week of Hamvention. As in past years, work areas were separated into computer software, AMSAT publications, and 'trinkets', such as shirts, decals, mouse pads, etc. AMSAT had a line of "satellite fashions" including a white AMSAT golf shirt with embroidered logo and new yellow T-shirts with an embroidered logo that was very popular. (A number of hams do their clothes shopping at Hamvention!) There were at least six volunteers on duty at all times. Martha Saragovitz and Bob Carpenter, W3OTC handled membership issues and donations while our volunteers handled the myriad of questions, new and renewing memberships, materials, etc.



Bob Carpenter, W3OTC demonstrates NOVA to Dayton Hamvention attendees. (AMSAT-NA photo by Keith Baker, KB1SF)

The Hamvention commercial area opened at 1200 on Friday, and the booth was soon humming with activity which did not end until 1800. Saturday was a full day of activities, with booth operations starting at 0800 and capably manned by our enthusiastic volunteers. There were computer displays of NOVA (Version 2.0 on CD-ROM was now available), WiSP, InstantTrack, MacDoppler (a new MacIntosh satellite tracking program now available through AMSAT) and a demonstration of the APRS/MIR experiment (provided by Bob Bruninga, WB4APR). Keith Pugh, W5IU spent many hours demonstrating NOVA and InstantTrak, with a steady stream of onlookers being briefed on the capabilities of these programs. Lou McFadin, W5DID demonstrated MacDoppler program on a Macintosh computer, as well as having on display an interface box which permits control of rotors by the program.

AMSAT Office Manager, Martha Saragovitz survives another Hamvention. Barry Baines, WD4ASW (left) and Howard Ziserman, WA3GOV (right) lend a hand. (AMSAT-NA photo by Keith Baker, KB1SF)

Our volunteers kicked off a new Phase 3D fund raising effort that was announced just prior to Dayton: The *Fly Your QSL* campaign. For a suitable donation to AMSAT, an individual's QSL card will be scanned and placed on a CD-ROM to be installed on Phase 3D. A number of individuals left their QSL card (with donation to Phase 3D) with Martha.

The AMSAT booth also had several guests who stopped by to help promote our activities. Rick Fleeter, WA8VGK, the author of *Micro Space Craft*, was available at the booth Saturday afternoon to answer questions pertaining to satellite design and operations (his book is available through AMSAT). Another guest at the booth was Don Agro, VE3VRW, author of *MacDoppler* who helped demonstrate his new program.

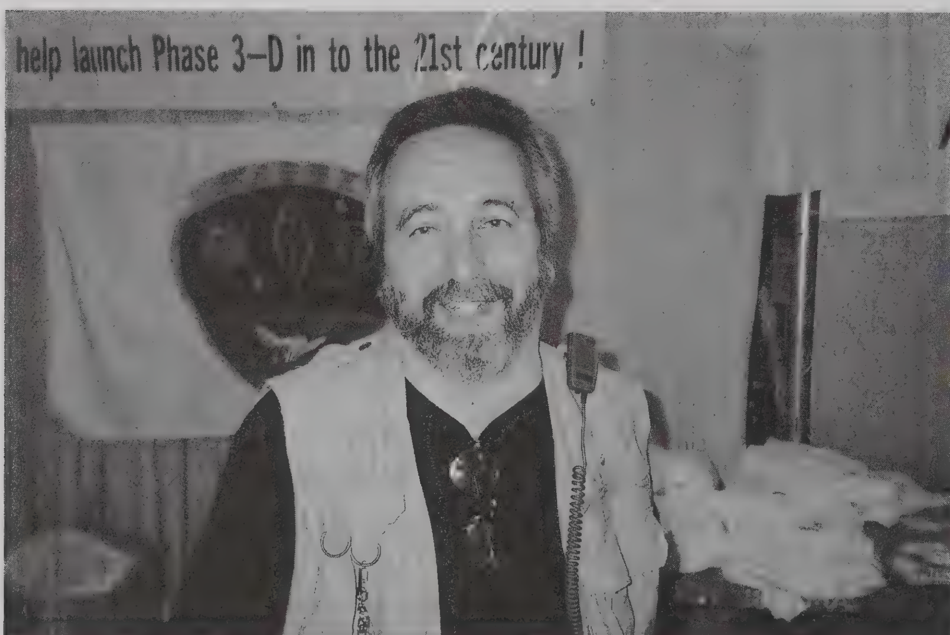
AMSAT's total donation receipts were better than expected due to the high interest in our newly revised publications as well as the Arrow Antennas. The final estimate of attendance at the Hamvention as reported by an official of the Hamvention committee placed this year's count at just over 28,000 which is up somewhat from last year. The weather was very warm all three days (in the 80's) with no rain during the Hamvention. The high temperatures and large crowds resulted in a very warm Hara Arena. All of our volunteers were very busy during their respective shifts and endured the pleasure of standing on their feet for 1-2 hour shifts in a muggy environment. Despite the working conditions, everyone maintained a smile on their face while answering questions and assisting those interested in establishing memberships, obtaining the latest AMSAT materials, or making a donation.

Presentations

A second area of Hamvention preparation was the variety of excellent presentations made by AMSAT personnel at two different AMSAT forums. Our presenters spend a considerable amount of time preparing their materials and closely coordinating how much time will be spent on each area within the limited forum time available.

The Hamvention committee inaugurated a new forum schedule this year, with forums starting at 0815 on Friday rather than at 1215 after the opening of the commercial exhibit area. This expanded forum time offset the net reduction in forum rooms at Hara Arena due to the committee converting space that had been previously utilized for forums to commercial exhibit space. Unfortunately, AMSAT was awarded only two forum times in what some may consider to be 'non-prime time' (Friday 0815-1015 and Sunday 0815-0930). It turns out, however, that both forums were well attended despite the early starts.

The Friday forum moderator was Bill Tynan, W3XO. Barry Baines, WD4ASW spoke about *Getting Started on Amateur Radio Satellites*. The presentation gave an overview of satellite basics and emphasized where to get information, such as AMSAT publications, various Internet sites, and periodicals. It was during a discussion of periodicals pertaining to amateur radio satellite program that Sharon, KB9SH and Gene Harlan, WB9MMM of Harlan Technologies announced to the AMSAT forum attendees that they had reached agreement with Bob Myers, W1XT of Bob Myers Communications to take over publishing of OSCAR Satellite Report. After 19 years of publishing, W1XT has decided to move on and do other things. Congratulations to the new publishers on their new endeavor and many thanks to W1XT for his strong support of the amateur satellite program over the years.



Don Argo, VE3VRW, introduced his new MacDoppler tracking and Doppler tuning program for Macintosh computers at the AMSAT Dayton Hamvention Booth. Registration numbers are available from AMSAT Headquarters. (photo by Ron Long, W8GUS)

The discussion of Phase 3D was led by Lou McFadin, W5DID who provided a comprehensive overview of Amateur Radio's most ambitious satellite project to date. Bdale Garbee, N3EUA provided information on RUDAK and the digital side of Phase 3D, while Keith Baker, KB1SF and Bill Tynan, W3XO discussed launch status.

Rosalie White, WA1STO and Matt Bordelon, KC5BTL made presentations on SAREX and ISS (International Space Station), emphasizing the significant role of Amateur Radio in manned space operations and outlining current efforts to meet deadlines for equipment to be installed during the first phase of ISS.

The second AMSAT forum was given on Sunday and was moderated by Keith Pugh, W5IU, AMSAT's VP-Operations. Keith Baker, KB1SF, provided an overview of Phase 3D status. His remarks were meant to provide information to attendees who were not present at the Friday forum. The main speaker was Ed Krome, K9EK, who is well known for his enthusiasm and knowledge of the microwave bands. Ed gave a presentation *Mode S and Above...Preparing to use the Higher Bands on Phase 3D* which was well received by a full room of attendees.

AMSAT Dinner

Unlike other *unofficial functions* during Hamvention, the AMSAT dinner on Friday evening is purely a social event with no presentations, talks, agendas, etc. Many members appreciate this opportunity socialize, unwind from a long day at the Hamvention, and meet new friends. Social Hour started at 1830 and dinner started at

1930. Ed Collins, N8NUY, coordinated the annual AMSAT dinner, handled advanced reservations, manned the AMSAT booth on Friday afternoon to reconfirm reservations, collected dinner monies at the door, and served as liaison with the Amber Rose Restaurant in Old North Dayton. This is the same location as was used the past few years and the 46 attendees enjoyed an excellent buffet that was moderately priced. The consensus of the dinner group is that AMSAT should hold next year's dinner at the same location.

The Saturday evening Hamvention banquet was sold out. AMSAT's Bob Bruninga, WB4APR, received the Technical Excellence Award for his pioneering work on APRS. The dinner speaker and evening's entertainment was country music entertainer Ronnie Milsap, WB4KCG.

In summary, Hamvention was marked by a number of successes:

- AMSAT offered the popular Arrow 146X437-10 Satellite Antenna with 10-watt duplexer.
- A number of AMSAT publications were updated and made available for the first time.
- *The Fly Your QSL in Space* Fund Raising Promotion for Phase 3D was introduced at Dayton.
- Terry Douds, WB8CKI, produced a new video on Phase 3D Integration at Orlando, using footage shot by Keith Baker, KB1SF, and Bill Tynan, W3XO.
- Bob Bruninga, WB4APR, had a demo of the APRS/MIR Experiment running on a PC.
- Lou McFadin, W5DID, had a demo of a new Macintosh software product, *MacDoppler* that was also demonstrated by the author, Don Agro, VE3VRW.
- Rick Fleeter, WA8VGK was on hand at the AMSAT booth on Saturday to discuss his book, Micro Space Craft which is available from AMSAT.
- Version 2.0 of NOVA tracking software offered for the first time on CD-ROM.
- The latest in 'satellite fashions', including white golf shirts and yellow T-shirts with embroidered AMSAT logo.
- Presentation of the Dayton Amateur Radio Association *Technical Excellence Award* to AMSAT member Bob Bruninga, WB4APR for work with APRS.
- An outstanding group of AMSAT volunteers manned the booth.

Once again, AMSAT made a significant impact on the Dayton Hamvention through the quality and variety of forum presentations, a very professional and impressive booth display, extensive materials pertaining to the Amateur Radio satellite program, and the opportunity to socialize and exchange ideas. Our achievements could not have happened without the hard-working volunteers who stepped forward to construct and man our exhibit, answer the myriad of questions, make the presentations, and generate enthusiasm for AMSAT. The fact that many of our volunteers were individuals who assisted in previous years reflects upon their dedication and enjoyment they receive by helping out each year. As noted in past years, Dayton Hamvention is both a physically demanding and fun-filled weekend coupled with a great sense of teamwork and cooperation that resulted in another success for AMSAT. Thanks! ■

Thanks to AMSAT Dayton Volunteers

Many thanks to the following members who volunteered a portion of their time at Dayton to help make AMSAT one of the best looking and most informative exhibits at the Hamvention.

- Barry Baines, WD4ASW, Jacksonville, FL
- Keith Baker, KB1SF, Xenia, OH
- Dave Borkowski, AA2GF, West Senaca, NY
- Frank Cahoy, K0BLT, Bridgeport, NE
- Bob Carpenter, W3OTC, Rockville, MD
- Ken Chaffee, WA1QXR, Ashaway, RI
- Ed Collins, N8NUY, Dayton, OH
- Steve Culp, K8QKY, Ann Arbor, MI
- Terry Douds, WB8CKI, Lancaster, OH
- George Hoffman, W2CID, Stanley, VA
- Bruce Howes, KG2IC, East Amherst, NY
- Dee Internado, NB2F, Lodi, NJ
- Jim Keeth, AF9A, Indianapolis, IN
- James Kelly, KK3K, Philadelphia, PA
- Malcolm Keown, W5XX, Vicksburg, MS
- John Klem, N3KHK, Beltsville, MD
- Larry Koziel, K8MU, Roseville, MI
- Ed Krome, K9EK, Columbus, IN
- Pat Kilroy, WD8LAQ, Bowie, MD
- Jerry Malin, N2HV, Matthews, NC
- Ed Manuel, N5EM, Houston, TX
- Lou McFadin, W5DID, Orlando, FL
- Mac McMillan, W8XF, Charleston, WV
- Mal Preston, NP2L, Cruz Bay, VI
- Keith Pugh, W5IU, Ft. Worth, TX
- Andy Reynolds, WD9IYT, Rochelle, IL
- Martha Saragovitz, Silver Spring, MD
- Andy Skattebo, KA0SNL, Petersburg, IL
- Jerry Smyth, N8ULU, Dearborn, MI
- Bill Tynan, W3XO, Kerrville, TX
- Howard Ziserman, WA3GOV, Owings Mills, MD

A Summary of the 1998 AMSAT-DL Symposium Detmold, Germany

Translated by John Bubbers, W1GYD

The 1998 meeting of satellite friends occurred with two prerequisite subjects: The wait for Phase 3D and our future. The keynote theme for the speakers this year was to cast their view beyond the satellite orbits and to look into the future. Naturally unavoidable is the current status of the Phase 3D satellite. Another meaningful event: The annual main meeting of the AMSAT-DL was held concurrent to the Symposium. It took place simultaneously with the presentations.

In Sequential Order

As usual, again this year, some satellite colleagues met as early as Friday. Some well known but little heard call signs in the Detmold area surfaced on the repeaters and the call-in frequency. Good mood and anticipation were clearly visible. Accordingly there was a proliferation of direct or radio conversations in one or the other gastronomic establishments.

The early participants arrived on Saturday and worked diligently on the preparations. There was also the opportunity for welcoming conversations at the breakfast stand. At 0900 the rooms were opened and 125 participants were signed in on the distributed attendance sheet. The meeting began at 0930.

Holger Flemming, DH4DAI opened the presentations with a demonstration of the mechanisms and techniques of radio astronomy. This was a completely different look at radio technology. Surely, there are few radio amateurs who have given their dx distance in light years, and respectively evaluated their signal strength, which is 30 dB (yes 30 dB) below !!! the noise level. Both of these parameters are part of radio astronomy.

The second presentation was by Thomas Kieselbach, DL2MDE who reported on the plans for the international space station, which will have its first module launched this year. There will also certainly be an operational Amateur Radio station on board. If the installation is built, as Thomas presented it, it will be a very decent shack. In any event, the proposed effort of a distinctive radio amateur installation makes one thing clear: Amateur Radio enjoys an important position. It will become interesting and is even now interesting, to study the planned station's concept. A great deal of progress has been made since Owen Garriot, W5LFL, called "*CQ from spaceship Columbia*" with his handheld rig.

Symposium Organizer Ulf Drewes, DL2YFA (r) thanking Freddy de Guchteniere, ON6UG (l) for his presentation.

Heinz-Joachim Woelky, DK2UO, then reported on the star direction finder project *Stockert*. This was in consideration that for several years the radio telescope on the Stockert by Bonn has not been in operation. There, a group of interested individuals, including a meaningful number of radio amateurs, are trying to maintain this installation. Large antennas are always interesting to radio amateurs. Here is one that is threatened with falling into decay. Heinz-Joachim reported on the past activities and demonstrated that there are ways in which to make such gigantic device useful to the radio amateur, although they are far too expensive for the individual radio amateur. Much has been accomplished and the future doesn't look bad for the Stockert Project.

The next lecture was by one of the faithful of the AMSAT-Symposiums, Freddy de Guchteneire, ON6UG. Since 1997 in Weinheim, he has introduced a new transceiver concept for microwave transceivers for the Gigahertz domain: Direct conversion! Small, light and completely reproducible. Not only did Freddy take up the idea, but he also expanded the utility of the device by one band, 10 GHz. As an example of the 10 GHz system Freddy explained and demonstrated the theory and construction as well as its limitations. The question of construction parts quickly followed.

At the mid-day break one could see a long, patient cue waiting at the attractively setup Bill's Fish and Chips food wagon. It could well have located in front of a London museum. In the foyer there was again a stand with the AMSAT goods offerings, tended by Reinhard Richter, DJ1KM and of ATiS e.V (Amateur Radio and Telecommunications in the Schools), tended by Ulrich Wengel DK2SM. As always, a satellite tracking program was demonstrated by Erich Eichmnann, DK1TB.

After the mid-day break Phase 3D was again the subject. Werner Haas, DK5KQ, reported on the experiments on board the satellite. Apparently the project is constantly progressing. He described 39 individual modules and the attendant adapted amplifiers and various peripherals. The

weight has grown from 400 kg at the beginning to well over 600 kg. In the past few months a RISC computer has been added (*Editor's note: See article in this issue*). This is where the on-board computer technology of the future is to be tested. In the meantime, the modules have been linked together and have been connected to the control computer. The satellite was put into full operation. And everything worked!

Appropriately following Werner's presentation Peter Guelzow, DB2OS, explained the digital aspect of the project. The complexity of the project is breathtaking. The kilometers of wire in the cable harness result in a remarkable fish net, there are some 5000 wire connections. It is impressive that it's even possible to maintain an overview. It is not possible to present an overview in a few words.

The last talk of the day was reserved for the head of the AMSAT-DL, Dr. Karl Meinzer, DJ4ZC. He made his actual presentation in an advance synopsis of the launch possibilities for Phase 3D. To repeat it here would be to distribute the snows of yesterday.

Karl Meinzer expressed his thoughts verbally about the future of AMSAT and Amateur Radio in general. To this end he showed the anticipated development in space travel. It will not become easier for radio amateurs to get satellite launches in the near future. In an overview of the previous development, OM Meinzer said it appears that the preoccupation with the radio medium itself was the nucleus of radio amateur activity and in his opinion further development has not been ruled out. The radio amateur must do things that no one else has yet done, or those things others not considered worth doing. As an example OM Meinzer proposed experiments in the realm of the small millimeter wavelengths. We must succeed in raising the interest of the youth, and here he brought in a local paper which made the point: youth must be offered the opportunity.

At the end of the lecture, there was a short break, and then began the spurt to the end, the annual main meeting, which has been reported elsewhere.

Although the lecture times were shortened, the lecturers are to be expressly thanked for their understanding, everything was extended and it became a long day. In spite of everything the hall was as full at the end as it was at the beginning. Obviously, nobody wanted to miss anything. The regular ending was then to be found in the Hotel "Diele" with good food, good drink, and above all good conversation. And the departing words most frequently heard were, "until next year".

Meanwhile, (German) transcripts were printed and are available for DM 10.-plus 3.- S&H from:

Ulf Drewes, DL2YFA
Hoerster Str. 94
32791 Lage, Germany
Tel/Fax 011-052-327-1515

AMSAT-DL Vice President Werner Haas, DJ5KQ presents the current status of the 39 electronic modules of Phase 3D.

A 47 cm Parabolic Reflector with a 10 GHz crossed dipole radiator.

Comments of the Radio Amateur Satellite Corporation Before the Federal Communications Commission, Washington, DC 20554 In the Matter of Petition Filed by The Land Mobile Communications Council (RM-9267) to Reallocate Portions of the Amateur 70 cm Band to Land Mobile Use

The Radio Amateur Satellite Corporation (AMSAT) respectfully submits these comments opposing the petition filed by the Land Mobile Communications Council.

Background

1. AMSAT, a not-for-profit District of Columbia corporation established in 1969, is the principal membership organization of the amateur-satellite community in North America. Our membership currently numbers about six thousand. Together with over thirty of our affiliated organizations throughout the world, we have constructed, launched and operated over two dozen satellites to date in the amateur-satellite service, of which many are presently in operation. These currently operational spacecraft include one high-altitude, Molniya-type orbit transponder satellite capable of sustaining two-way communication over terrestrial paths well in excess of 10,000 miles (AMSAT-OSCAR 10), several low-earth-orbit (LEO) digital store-and-forward packet radio satellites, scientific and educational payload satellites, LEO analog transponder satellites, and spacecraft featuring combinations of these types of payloads.

2. Additional satellites for the amateur-satellite service are planned, or are presently under construction, by AMSAT and its affiliate organizations in various countries. Many of these groups are associated with universities or have access to government or industry facilities in their countries. Indeed, owing to the worldwide and cooperative nature of amateur radio, the construction of satellites for the amateur-satellite service has emerged as an important means of technology transfer to developing countries. One not-for-profit organization, Surrey Satellite Technologies Ltd., affiliated with the University of Surrey in the United Kingdom; has built or aided in the construction of a number of such satellites. Over the next ten to twenty years, it is certain that further proliferation of this highly beneficial activity will take place, provided suitable spectrum is maintained for its use.

3. AMSAT itself is currently working with amateur satellite construction groups in nearly a dozen countries to build the fourth and most advanced in a series of elliptical orbit amateur satellites called *Phase 3D*. This spacecraft is expected to be launched later this year on an Ariane launch vehicle. One of the principal frequency bands that Phase 3D will employ, is the 435 - 438 MHz segment of the 70 cm band. The spacecraft includes both a transmitter and a receiver in this band, either of which can be switched to use a high gain array or an omni-directional antenna.

4. Another important project, which is destined to make heavy use of the 435 - 438 MHz amateur-satellite service allocation is amateur radio involvement on the International Space Station (ISS). Amateur radio has been accepted as a payload for ISS and AMSAT, along with amateur groups from a number of countries, is currently actively pursuing designs for equipment to go aboard the Station.

5. Unlike commercial satellite services for which the use of geostationary spacecraft is economically feasible and common, the amateur satellite service currently utilizes satellites in low Earth orbits or highly elliptical orbits, which serve all, or most, of the globe with one set of uplink and downlink frequencies. For this reason, amateur satellite frequency allocations must be coordinated internationally so that they are available for use on a worldwide basis.

6. Amateur satellites are also completely different from satellites built for government or commercial applications in another way. In the case of commercial or government satellites, while the spacecraft is being constructed and prepared for launch, suitable ground station equipment is being developed and deployed. Usually, both of these are funded and directed by the same company or government agency. This assures that the ground equipment will be in place when the space segment comes on line and the two will be compatible with one another. This is not the case with amateur satellites. Amateur satellites are constructed by a specific amateur group such as AMSAT, or a collection of such groups. In planning the satellite, the constructors attempt to understand the current and future capabilities and needs of individual amateurs throughout the world, not just in their own country. This often means that they must compromise in the design of the satellite, frequently choosing lower frequency bands and lower-speed data rates than would be optimal otherwise. This creates somewhat of a dilemma for amateur satellite builders. If the lower bands are too crowded and the higher bands present too great a challenge to people in poorer countries, the use of intermediate bands such as 70 cm (435 - 438 MHz) becomes mandatory.

7. The intense crowding taking place on the lower amateur bands available to amateur satellites, necessitates the use of the higher bands for them. Particularly bad is the situation in the 144 - 146 MHz band, in which the amateur-satellite service is co-primary with the amateur service. This is the only portion of the VHF spectrum presently allocated to the amateur satellite service by the ITU. Because of intense usage by other amateur applications, the only part of this band regularly used by the amateur satellite service is 145.8 - 146.0 MHz. Co-channel and adjacent-channel interference, a direct result of the intense crowding, is increasingly making the band difficult to use for satellites, especially for the relatively weak signal satellite downlinks. In addition to legitimate amateur use of the band; the ready availability of inexpensive equipment, intended for the amateur market, has resulted in extensive use of this band by non-amateurs for personal and commercial communications in many countries, especially in Central America, Asia and the Pacific Rim, despite ITU regulations to the contrary. First-hand observations by radio amateurs flying in space aboard the Space Shuttle and MIR have confirmed that this is a significant and growing problem. All of this crowding in the 2 meter band, makes migration to higher frequencies all the more urgent. For this reason, increased emphasis must be placed on their use, for future amateur satellites, especially 435 - 438 MHz.

8. Over a dozen presently operating satellites currently utilize the 435 - 438 MHz segment of the 70 band. A significant portion of that current satellite activity involves store and forward digital message traffic originating in the amateur packet network system. Thus, many amateurs, who may not even know that their messages are going through satellites, are utilizing satellite communication, whether they know it or not.

9. Two internal problems facing amateur radio are also important here. They are the proliferation of modes of operation, many inherently wideband in nature, and the increasing number of amateur radio operators resulting from the institution of the code-free license. For example, several manufacturers currently offer low cost amateur television transmitters for the 420-450 MHz band. As no such amateur television equipment is manufactured commercially, for any of the amateur bands above 450 MHz, this band receives the brunt of amateur television operation. Many of these commercial amateur TV transmitters, and most home constructed units, transmit signals 8 MHz in width (both sidebands). Thus, their operation often causes interference to other amateur activities, including amateur satellites in the 435 - 438 MHz amateur-satellite service band.

Effect of Favorable Action by the Commission on the LMCC Proposal

10. AMSAT contends that, if the LMCC proposal for reallocation, or sharing, of 420 - 430 MHz and/or 440 - 450 MHz, is implemented, even more of the aforementioned amateur television operation, as well as other amateur activity such as FM simplex and remote bases, will be forced into the 435 - 438 MHz amateur-satellite service segment of the 70 cm band.

11. Indeed, any spectrum lost by amateur radio puts additional pressure on remaining spectrum. Proof that the LMCC proposal seriously threatens the amateur-satellite service segment at 435 - 438 MHz, by causing other amateur activities to crowd into what remains of the band, can be found in the fact that satellite operation in that segment has already been impacted by the loss of 420 - 430 MHz in some parts of the country, as well as the heavy use of amateur repeaters in the 440 - 450 MHz segment. These factors have already caused an increasing number of amateur television operators to use frequencies in the vicinity of 435 MHz. Thus, it is quite logical to conclude that complete loss of 420 - 430 and/or 440 - 450 MHz; or substantial sharing of them with PMRS operators, will have a an even greater impact on satellite operations in this band.

12. AMSAT is concerned that sharing between PMRS operators and terrestrial amateur communication in the proposed band segments is not feasible. As stated in 14 below, it would be expected that the PMRS operators would employ conventional FM, just as do the amateur voice repeaters in that part of the spectrum. Thus, each would occupy similar bandwidths. In many parts of the U.S. particularly the large cities, the amateur band from 440 - 450 MHz is already completely filled with amateur voice repeaters. It is certain that these same cities are the areas in which PMRS is especially in need of additional space, and thus would be bear the brunt of any sharing that might be attempted.

13. The 420 - 430 MHz segment, in the portions of the country where it is available, is widely used by amateurs for voice and data links, as well as for amateur television. It is almost certain that amateur repeaters, links and amateur television operators, experiencing interference from PMRS operators, operating in the proposed band segments, would seek to move to the 430 - 440 MHz segment, including the 435 - 438 MHz amateur-satellite service segment. This kind of situation has already been shown to be a significant problem in

the many other countries of the world; where only 430 - 440 MHz, or parts thereof, is available for amateur operation, and all modes must share this narrow band of frequencies. In AMSAT's opinion, acceptance of the LMCC proposal, will guarantee that the same bad situation will exist here in the U.S. to an even greater extent than it does today.

Alternative Approaches to Meeting LMCC Perceived Needs

14. The LMCC petition is unclear as to how PMRS would make use of the spectrum they are seeking. Nothing regarding the technology that would be employed is covered in their filing. One can only assume that conventional FM would be utilized. There is no discussion of the use of more modern technology such as spread spectrum (SS) or amplitude compandored single sideband (ACSSB). Monitoring by AMSAT members has shown that ACSSB equipment is being used in the 220 - 222 MHz band reallocated from the amateur service several years ago. Thus, it would appear that suitable ACSSB equipment is available.

15. AMSAT suggests that consideration be given to placing ACSSB channels between existing FM channels in the bands already allocated to PMRS. Eventually, all land mobile operation could be converted to ACSSB, multiplying the number of available channels by a factor of 4 or 5. Alternatively, the use of SS systems, overlaying existing PMRS allocations offers another possibility.

Conclusions and Recommendations

16. Even though the proposal offered by LMCC does not directly address amateur -satellite service allocations, AMSAT believes that its implementation will have a major impact on amateur satellite operation in this important band, both in this country and abroad.

17. Furthermore, AMSAT contends that, in this instance, as in any other situation which might impact a band allocated to the amateur-satellite service; consideration must be given to the potential impact that any action taken might have in the rest of the world, as well as this country.

18. For the reasons cited, the Radio Amateur Satellite Corporation strongly urges that the Commission not consider reallocating, the frequency bands proposed by LMCC to PMRS, or allowing sharing by PMRS with current amateur operations in these bands. Further, we urge that LMCC explore other frequency band alternatives and/or newer technologies that would permit them to meet their needs using the frequencies already allocated to them, before they seek the use of amateur frequencies.

RESPECTFULLY SUBMITTED,
Radio Amateur Satellite Corporation
P. O. Box 27
Washington, D.C. 20044

By: William A. Tynan, President
May 29, 1998

Distribution:

Radio Amateur Satellite Corporation Board
American Radio Relay League
Land Mobile Communications Council ■

Comments by the Radio Amateur Satellite Corporation Before the Federal Communications Commission In the Matter of Compliance with Voluntary Band Plans in the Amateur Radio (RM-9259) Service

Summary

The Radio Amateur Satellite Corporation (AMSAT) wishes to voice its support for the American Radio Relay League's position in the Referenced proceeding.

Introduction

The Radio Amateur Satellite Corporation (AMSAT) is a not-for-profit District of Columbia corporation established in 1969. It is the principal membership organization of the amateur satellite community in North America. Our current membership is approximately 6,000. Together with affiliated organizations throughout the world, we have constructed, launched and operated over thirty satellites to date in the Amateur-satellite Service, of which many are presently in operation. AMSAT is currently constructing a new satellite presently designated *Phase 3D* expected to be launched later this year by the European Space Agency. It is designed to provide wide area amateur communications transmitting on Amateur-satellite Service bands from 2 meters to 1.25 cm. Phase 3D will provide approximately 500 kHz of bandwidth on all of the bands on which it will transmit, except for 2 meters where the bandwidth will be limited to 200 kHz by frequency coordination within the amateur community.

Background

On April 3, 1998 the American Radio Relay League, through its attorneys Booth, Freret, Imlay and Tepper, filed a Request Declaratory Ruling requesting the Commission to include in its rules, language that re-affirms the concept that *good amateur practice* includes operating in accordance with the voluntary band plans that have been established in the Amateur Radio Service.

AMSAT's Position

AMSAT wishes to express its support for the League's initiative.

Included in these band plans, that have been widely accepted by the amateur community, are provisions for using certain portions of the amateur bands for space communication. Some of these so-called satellite bands are mandated by ITU regulation, while others are strictly a matter of *gentlemen's agreement* within the amateur community. In either case, AMSAT feels strongly that these band segments must remain as space communication sub-bands with a minimum amount of interference from other types of amateur operation. We feel that Commission action in implementing the ARRL initiative can contribute materially toward this objective.

Therefore, AMSAT urges the Commission to act favorably on the Leagues's initiative in this matter.

RESPECTFULLY SUBMITTED,
Radio Amateur Satellite Corporation
P. O. Box 27
Washington, D.C. 20044

By: William A. Tynan, President
May 29, 1998

Distribution:
AMSAT Board of Directors
Booth, Freret, Imlay and Tepper ■

Special Events Station Planned for AMSAT-NA Symposium

The Vicksburg Amateur Radio Club (VARC) will operate a special events station for the 16th Space Symposium and AMSAT Annual Meeting that will be held in Vicksburg, Mississippi. The station will operate on October 17 and 18, 1998 under the VARC club callsign K5ZRO in the general portion of 40, 20, 17, 15 and 10 meter bands. In addition a satellite station will operate on analog satellites.

QSL cards commerating the special event station can be obtained by sending a SASE to Ed Magurder, N5QDE, 2485 Warrenton Road, Vicksburg, MS 39180-7610.

Tours of the special station for AMSAT symposium participants will be offered during the symposium. ■

AMSAT Journal Telemetry

Amateur Satellites-Today and Tomorrow Workshop at ARRL Southwestern Division Conference

The ARRL in conjunction with AMSAT will hold a workshop at the ARRL Southwestern Division Conference called *Amateur Satellites - Today and Tomorrow.* The five-hour workshop will provide newcomers everything they need to get on the birds including:

- Digital satellites as orbiting bulletin boards(some with cameras)
- An FM satellite (AO-27) you can work with an HT and hand-held antenna
- Low earth orbit SSB/CW "Easy Sats" on 2, 10 and 15 meters
- High altitude satellites such as AO-10
- Russia's Mir and NASA's SAREX (soon, the International Space Station!)

Participants will learn about equipment requirements (plus antennas, rotators, feedline), operating protocol, how to track satellites with PCs, and prepare for using Phase 3D.

- WHAT: Amateur Satellites-Today and Tomorrow
- WHO: Instructors-AMSAT experts from various parts of the US.
- WHEN: Friday, August 14, 1998, 1PM (after lunch) - 6PM. Arrive early for materials.
- WHERE: At the ARRL Southwestern Division Convention.
- HOW: Space is limited. To register, call/write Dan Miller, K3UFG, telephone: 860-594-0340, at ARRL HQ before August 4, 1998.
- PRICE: $20 for ARRL members, $25 for non-members. Participants will receive free materials and five hours of instruction. Participants can also purchase *ARRL Radio Satellite Handbook*, beforehand, for $22(+$5 UPS shipping/ handling). Those attending all day earn 0.5 Continuing Education Units.

New *OSCAR Satellite Report* Owners

Harlan Technologies recently purchased the *OSCAR Satellite Report* from R. Myers Communications. Sharon Harlan, KB9SH is the Editor and Gene Harlan, WB9MMM is Associate Editor. Please direct any material for publication, questions, and subscriptions to: *OSCAR Satellite Report*, 5931 Alma Drive, Rockford, IL 61108 or e-mail *Osreport@aol.com.*

The Traditional AMSAT Convention Jewelry Contest

Like Topsy, the AMSAT Convention Jewelry contest *just grew*. David WB6LLO and Leanore, KA6UCD Guimont designed the contest to provide an additional diversion for the ladies who might not be interested in all of the conference proceedings. It has endured for five years.

The first prize in Dallas in 1993 was fashioned from a part removed from the ignition module from a 1981 Oldsmobile. The surface mount devices substrate was mounted on a stainless steel heatsink. When shaped and polished a chain was added, and it made a beautiful lavalier. The object of the contest was to name the type of equipment from which it was removed, and guessing the year provided the tiebreaker. It was won by Franklin Antonio, N6NKF of InstantTrack fame. He properly identified it a part of an ignition module, and named the year as 1983.

The second contest in Orlando in 1994 was to estimate the frequency of a pair of earrings fashioned from silver wire, in the shape of a quadrifilar antenna. They were to scale, and accurately *measured* to a frequency in the ham bands of 5.78245 GHz. Franklin also won that contest with a guess that came within 50 kHz of that frequency just using his eyeballs!

The convention was held again in Orlando in 1995 and Orlando provided the material for this one. The year before, Dick Jansson, WD4FAB generously provided a scrap piece of the heat pipe that is being used on Phase 3D. Cut in thin sections and polished it made a very nice bracelet. The tie breaker was to guess the weight of the bracelet in grams (11.12). David Liberman, XE1TU, correctly identified the material and broke a four place tie with his guess of 8.6 grams.

The junk box tipped over in 1996 and provided material for the convention in Tucson. Copper wire coils in a pancake motor from a 3 1/2" disk drive provided the petals for a brooch fashioned as a flower. Thin copper sheet, and copper wire completed the stem. Earrings were made from the same material to provide an additional incentive. Ed Krome, K9EK, (at that time KA9LNV) won handily by properly identifying the drive.

Toronto was the chosen place in 1997 and the designers were running out of places to put jewelry! A device designed to assist in hooking on a bracelet called a *third hand* was devised. Basically it is an alligator clip with a long handle. This one was made from 50 ohm 0.141 Teflon hard line cut to the length of an open half wave stub. Coiled, it provided a handle for the alligator clip. The winner Roy Welch, W0SL, came closest to the measured frequency of 437.127595. Needless to say, a tiebreaker was not provided!

Fifty to seventy participants have participated each year. Entrants come mostly from the convention site, but they have come by ham satellite, telephone, e-mail, and snail mail. Accurate descriptions were provided, but some comments were made saying that convention-goers had an advantage. Others wanted something appropriate for a man. Others said they are too difficult for the average amateur. All of these things will be corrected for the 1998 contest in Vicksburg. The prize is unisex, the guessing a near lottery, and not even a picture is required. This year's item will be announced well before October of 1998!

Chuck Parmelee, W9ODI, SK

We are sad to report that Charles (Chuck) Parmelee, W9ODI, became a silent key on 4 May 1998. He had serious surgery in December but had made good progress until May. Chuck was a longtime supporter of AMSAT and was very active on both digital and analog satellites, especially FO-20 and FO-29. He will be sadly missed by his many amateur radio friends. The funeral was held May 7, 1998 at Kristan's Funeral Home in Mundelein, IL. His wife Evelyn and son Dan will be happy to receive cards and etc. at the callbook address or via email at *dparmelee@midwest.idsonline.com.* (via Ron Long, W8GUS)

Barry Goldwater, K7UGA, SK

Former US Senator, onetime presidential candidate, and noted Radio Amateur Barry Goldwater, K7UGA, died May 29, 1998. He was 89. Goldwater had suffered a stroke in 1996 and had been in failing health.

Senator Goldwater was a longtime friend of AMSAT, having appeared in a number of ARRL and AMSAT-sponsored videos about satellites over the years. In the early stages of the Phase 3D effort, he appeared with Roy Neal, K6DUE, in an AMSAT-sponsored fund-raising video for the project. The video was filmed in his well appointed "shack" at his home in Scottsdale.

"I had the good fortune to be there with the Senator during the filming of portions of our video," said Keith Baker, KB1SF, AMSAT-NA's Executive Vice President. "He was genuinely enthusiastic about what the Phase 3D satellite would offer to the world's Radio Amateurs, and that enthusiasm really showed in his on-camera comments. There is no doubt in my mind that we have now lost one of our most ardent supporters of Amateur Radio, Phase 3D and AMSAT", said Keith.

Long time AMSAT-NA Board Member Tom Clark, W3IWI, when learning of the Senator's passing noted, "I remember Barry operating mobile from his Corvette while driving to work on the Washington Beltway! For me it was an honor to have met him and talked about his love for Amateur Radio and technology in general. 73, Barry — you will be missed!" (via AMSAT News Service)

REGISTRATION FORM

16TH AMSAT-NA SPACE SYMPOSIUM & ANNUAL MEETING
BATTLEFIELD INN (FORMERLY PARK INN), VICKSBURG, MS
OCTOBER 16 – 18, 1998

Special Conference Rates: **$52 single/$62 double plus complimentary breakfast buffet and evening cocktails. When making your reservations reference the *AMSAT Conference*.**

Telephone Numbers for Reservations: **Toll-free in the United States: 800-359-9363 or commercial: 601-638-5811. Address: 4137 I-20 Frontage Road, Vicksburg, MS 39180 (I-20 Exit 4B/Clay Street)**

SOUTHWEST AIRLINES® is the official airline of the AMSAT Symposium providing a *10 percent* discount on airfares. To make reservations, call 800-433-5368 and reference K3308.

How Many?	Item	Cost	Amount
_______	Registration (Includes Conference Proceedings) Until September 15, 1998	$25.00	_______
_______	After September 15, 1998 ($35 at the door)	$30.00	_______
_______	Saturday Night Banquet	$20.00	_______
_______	Sunday Morning Field Trip (0900 – 1130) to US Army Engineer Waterways Experiment Station (Limited space on bus - first come/first served)	$10.00	_______

Make checks payable to AMSAT *Total Amount Enclosed* _______

VISA/MC (ONLY) ______________________ Exp Date: ______________________

Print Name: ______________________ Call: ______________________

Print Address: ____

Print City: ______________________ State/Prov: ______________________

Print Zip/Postal Code: ______________________ Country: ______________________

Daytime Telephone: ______________________ Signature: ______________________

Shuttle Transportation To/From Jackson Airport - One hour trip - $9.00 per person each way

Cash settlement made during Battlefield Inn check-in. *Please check shuttle preferences:*

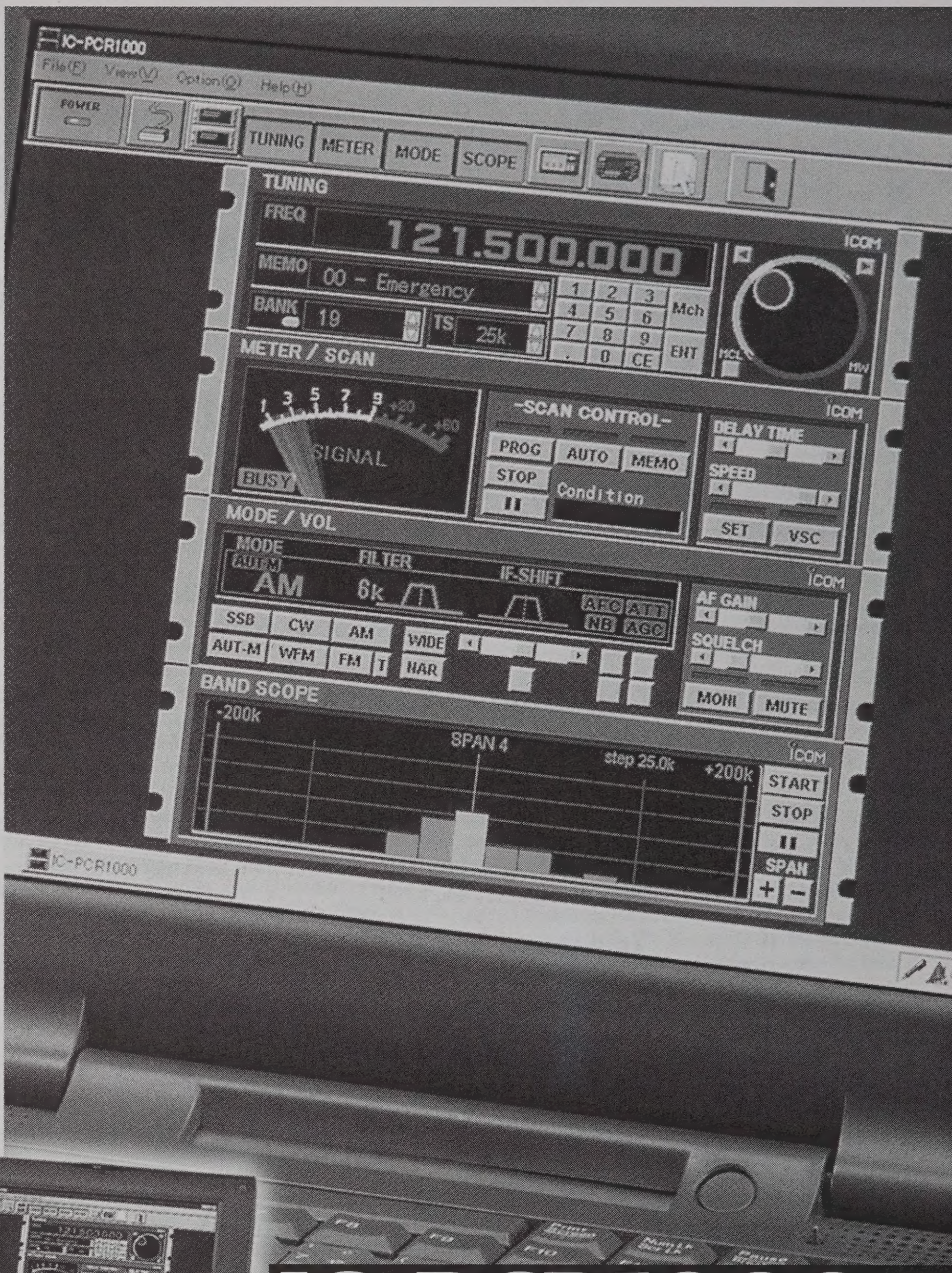
Jackson Airport to Battlefield Inn:	Thursday, 15OCT98	_____ 1400	____ 1700	____ 2000	Flight #_______
	Friday, 16OCT98	_____ 1000	____ 1400		Flight #_______
Battlefield Inn to Jackson Airport:	Sunday, 18OCT98	_____ 0700	____ 1130	____ 1500	Flight #_______

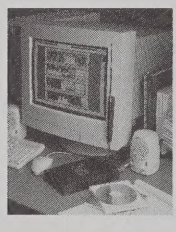
Other local transportation services are available: see Symposium WWW site for additional details.

Send to: *AMSAT, 850 Sligo Avenue, #600, Silver Spring, MD 20910-4703 (martha@amsat.org)*
Telephone: *301-589-6062* **Facsimile:** *301-608-3410* *http://pages.prodigy.com/DXHF93A*
Talk-in Frequency: *Vicksburg Amateur Radio Club Repeater: 147.270 MHz (+ offset/100Hz)*

WORLD WIDE RADIO

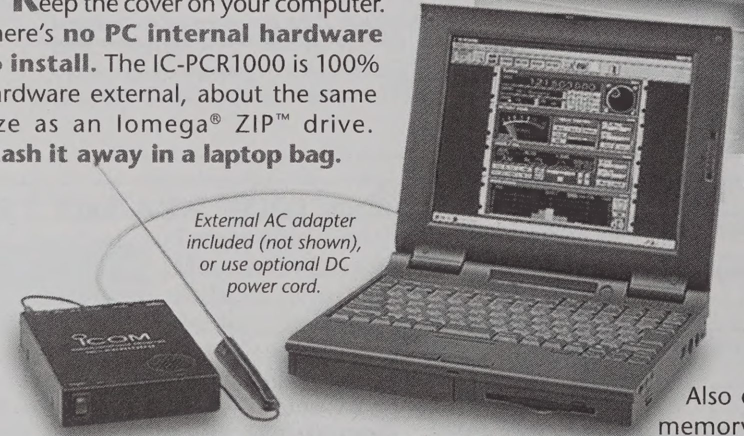
IN A LITTLE BLACK BOX





Combine powerful listening performance with go-anywhere PC convenience. ICOM's IC-PCR1000 wide band **multimedia** receiver is now available.

Keep the cover on your computer. There's **no PC internal hardware to install.** The IC-PCR1000 is 100% hardware external, about the same size as an Iomega® ZIP™ drive. **Stash it away in a laptop bag.**



External AC adapter included (not shown), or use optional DC power cord.

IC-PCR1000

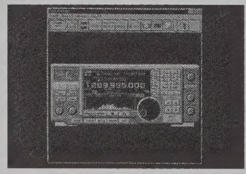
100% PC External World Wide Receiver

Designed for **Windows® 3.1** *and* **Windows® 95**

Take the black box with you to work, to school, on business trips, even while out camping or on a boat. **Catch receiver activity while working in foreground applications.**

The big reception on this little radio will surprise you. Monitor **500 kHz – 1300 MHz*** on **all modes** (AM/FM/WFM/SSB/CW).

Also enjoy: unlimited memory channels, real time band scope, tone squelch (CTCSS) decode, 5 DTMF memories for advanced remote computer control, a **9600 baud** data connection point for third party applications (like weather fax), and **optional DSP.**



Everything's included to get you started. And the latest software is always available for free downloading on the ICOM America web site. To get it, and to find your nearest authorized IC-PCR1000 dealer, visit **www.icomamerica.com** today. Or, for more information, call for a free brochure, 24 hours a day: **425-450-6088**

ICOM®

Makers of the world's best radios for over 40 years.